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No. 46

CONTENTS PAGE

CONTENTS (Continued) Page

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

EFFICIENT USE OF COMPUTERS IN PLANNING DISCUSSED

Moscow EKONOMICHESKAYA GAZETA in Russian No 23, Jun 78 p 14

[Article by Deputy Chairman of USSR Gosplan M. Ye. Rakovskiy in the column "Efficiency of Automatic Control System Application": "Well-Organized and Balanced Development"]

[Text] Carrying out the resolution of the 25th CPSU Congress, workers in the country's industries and planning departments are attempting to achieve maximum production efficiency by adopting computer hardware and variable-purpose automatic control systems. A high-performance base has been established in our country for manufacturing electronic computers and peripheral units for them. Production of computer hardware is also expanding continuously in the socialist countries. This problem is being solved through the joint efforts of the CEMA member-countries among whom the production volume and the products list of machines and instruments necessary for assembling complete variable-purpose automatic control systems has been distributed.

The work is being done on the basis of an Agreement on the Development of a Unified System of Electronic Computers (YeS computers) and Unified Principles for their Application. In accordance with the agreement, an efficient structure and equipment have been developed for monitoring the activity of the country's organizations and enterprises at the computer planning and development stage. This agreement is a dramatic example of successful economic cooperation, an example of a practical implementation of the complex program for deepening socialist economic integration.

Implementing a unified scientific and technical policy has made possible a substantial reduction in the time required for computer development and assimilation and has allowed the CEMA member-countries to increase the level of controlled operation in all sections of their socialist economic systems.

At the Center of USSR Gosplan's Attention

Efficient computer application in the national economy has always been the main focus of USSR Gosplan's attention. While analyzing the annual and five year plans, USSR Gosplan and the ministries determined that the extent

of savings from the use of computer equipment from 1976-1980 will amount to 3.8 billion rubles due to the availability of computer resources and operating conditions.

For 3 years of the five-year plan, in accordance with accepted planning arrangements and an approved standard capital investment efficiency, savings from the use of computers and automatic control systems have been posited in the ministries' plans in the amount of 1.6 billion rubles of which approximately 840 million rubles was from reducing the net cost of production. This sum was included in a section of the national economic plan "Profit and Net Cost." Other sources of savings are the growth of production volume, the increase in labor productivity and the quality of output achieved due to the use of computers and automatic control systems.

Numerous facts make it clear that using computer equipment causes a great economic impact. Today we may speak of the actual standardized efficiency of capital investments for this purpose. As early as 1973, USSR Gosplan in conjunction with the ministries approved a standardized efficiency factor for capital investments in the introduction of computer hardware at a level of 0.3 as opposed to 0.15 for the national economy as a whole.

Even at the first stage it has turned out that the approved efficiency factor for some areas was underestimated although the indicators were reduced due to the lack of a suitable facility for computer operations and of necessary information.

Actually, the resultant savings obtained by a wide variety of ministries (the coal and electronics industries and the transport and construction ministries) bear witness to the very high efficiency of the capital expenditures which amount to 0.36-0.42.

The efficiency ratio depends on a number of factors. The important ones are the availability of well-prepared problems, the quantity and complexity of the computer hardware obtained by users, the qualifications of the personnel operating the computer equipment and the availability of the required programs and information contents.

In 1978 USSR Gosplan and 18 ministries decided to pursue measures directed toward the improvement of the plan's indicators in 1979 aiming chiefly at increasing efficiency in the use of productive capacity.

It was also decided to include an indicator of the planned savings (the profit increase) due to the adoption of automatic control systems, singling out such units as the reduction of net cost.

Before the ministries and departments stands the task of bringing these planning assignments to the subdepartmental enterprises and organizations and including in them planning for the final national economic output on the basis of the methods developed.

A large amount of computer hardware is used in the area of scientific research during planning. We have to solve a number of problems associated with the improvement of analysis and estimation of the efficiency of computer hardware use in these spheres of activity. Experience in computer operation indicates that they permit a sharp increase in the labor productivity of workers involved in scientific research and planning, accelerate the process of development and assembly-line management of the new equipment, reduce expenses and improve the quality of the products manufactured. These results must find a reflection in planning indicators and in evaluation of the work of the collectives.

Eliminating Deficiencies More Vigorously

The country's national economy has a high-capacity production base available for computer development. Because of this the average yearly rates of growth in the fabrication of computer hardware in some ministries reach 25 percent. However, much remains to be done in the structure of computer equipment production. In the first place, balancing of the central processors and the required products list of peripheral units in production must be improved.

Scientific research institutes and design offices have been established in industry where qualified and experienced specialists work, but the time required for industrial assimilation of much of the more important peripheral equipment is excessively large. The appropriate ministries, by authorized specialization, must make plans to accelerate the delivery of terminals, magnetic disks, displays, graph plotters, data preparation devices and remote control data processing devices to users. More rigorous responsibility is needed for the timely industrial assimilation of new machines. But along with increasing the reliability of new computer models, systematic work must be done on increasing the reliability of existing computers.

The peripheral units we produce in this country for the most part meet the requirements of the machines in whose system they operate. Thus, the unit for controlling a magnetic tape storage file (YeS-5511) satisfies the technical specifications, having an average up time greater than 400 hours. The other units also have excellent indicators. For instance, the perforated tape input unit (YeS-6022) has an average up time of about 700 hours.

However, there are units which still do not fulfill the specifications for reliability. In particular, the average operating time of the alpha-numeric printer YeS-7032 is considerably lower than required by the technical specifications.

At the present time high-performance computer centers are being developed for collective use. More complete equipment is required for their effective operation. Specifically, display production must be expanded. Our industry has considerable capability for manufacturing televisions, a technology which is very close to displays, and yet the output of displays in the necessary quantity and kind has been delayed intolerably.

The performance of computer hardware and the operational efficiency of computer centers and automatic control systems has assumed an increasing significance. And constant emphasis must be placed on solving this problem. In this connection, it would be adviseable to improve significantly the systems for testing units in a number of institutes. It would also be expedient to organize special service for analyzing defects in the computer equipment and for developing proposals for eliminating them.

The matter of expanding the production of minicomputers, which are distinguished by low cost and high productive capacity for the solution of concrete problems, is a separate and very important problem in increasing the efficiency of computer use. Our specialists together with the specialists of the CEMA member-countries have developed a variable-purpose minicomputer system. We need a wide assortment of special peripheral units for this machine system (SM EVM) which make it possible to create SM computers at a cost 15-20 times lower than the cost of systems based on YeS computers. The production of Minpribor, a device of this kind, is taking place slowly although the necessary capabilities could be provided by removing various types of obsolete equipment from production.

Acknowledging the basic target task, the problem of increasing the efficiency of public-oriented production in the national economy, we must first attend to the development and strengthening of the statewide automatic control systems which have the greatest effect on the formation of the national income and therefore also on increasing the living standard of the Soviet people.

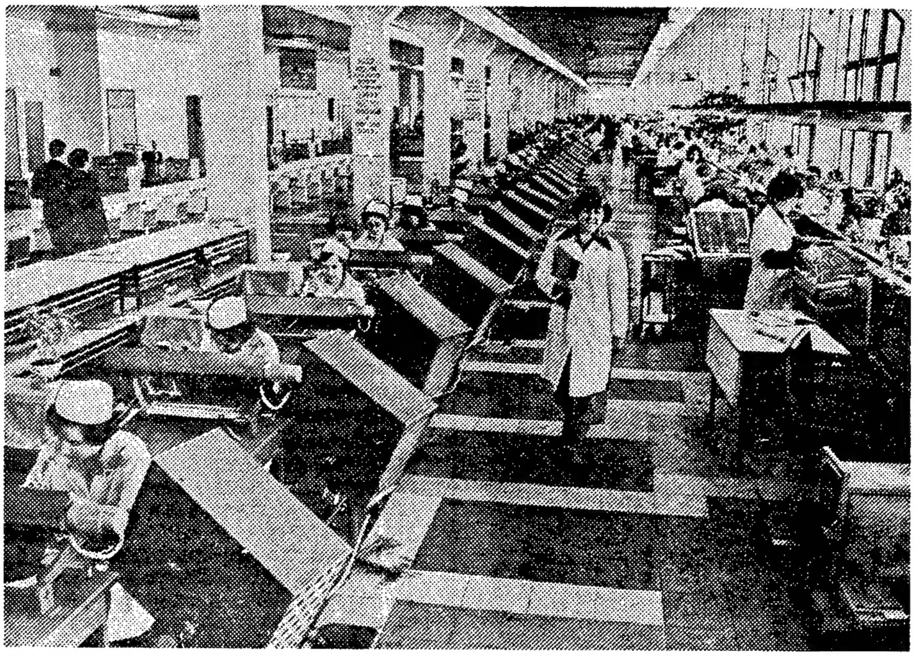
We are referring mainly to the Gosplan system--ASPR, the Gossnab USSR automatic control system, Gosbank USSR and the USSR computer control system.

The interaction of statewide systems with sectional systems ensures an increase in efficiency in all sections of the national economy. The operational efficiency of these systems is assured by the availability of reliable information and the use of a standardized base developed in the country's statewide and sectional computer centers.

Software Problems

Special attention must be devoted to the further development of software for automatic control systems. Unfortunately, some institutes of the USSR Academy of Sciences have yet to take a key role in developing a programming methodology and the administration of the State Committee on Science and Technology does not coordinate work plan execution in this area adequately.

It is necessary to treat the improvement of programming separately. During recent years, the complexity of problems solved on computers has increased considerably and the area of computer equipment use has been expanded. For instance, the development of the YeS Series-1 operating system for achieving use of all the functional resources of the higher level YeS Series-2 which is under development is governed by a labor intensiveness of 1600-2000 man years.



Hundreds of enterprises and institutes of various economic sectors use electronic computers made by the Kiev plant for computing and control machines--the main enterprise of the "Elektronmash" industrial combine. Computers made at the Kiev plant are also exported to Bulgaria, Poland and Czechoslovakia. A consignment of the large M-4030 computers will be sent to the fraternal countries this year. The photograph shows one of the plant's shops.

As a result of the complexity of the problems, a substantial redistribution of expenditures on computer system development is taking place characterized by a reduction of the relative share of expenditures on equipment and an increase of their share for software. Domestic and foreign experience indicates that the cost of developing software consists at this time of more than 50 percent of the overall cost of computer system development.

It would be especially desirable to point out the necessity for improving the development of programs for ASUTP's. The results of inspections carried out show that, on the average, adopting ASUPT's ensures increasing production output by 3-7 percent while significantly lowering the outlay for raw materials, equipment and energy. In addition to the economic efficiency factors due to ASUTP use, it is very important to keep in mind the social value of incorporating such systems in use. The working conditions of the personnel are considerably improved and the work of the engineers and technicians assumes a creative character. The information resources of the systems make possible an increase in the effectiveness of socialist competition and the development of the personal initiative of the workers.

Ever increasing expenditures on the development of software make it necessary to investigate ways to drastically increase the labor productivity of programmers and the performance of the programs developed. In this connection, there is an emphasis on the creation of systems for special programmer training which make it possible to provide for the development of the operating system and to use all of the functions built into it. At the present time two institutes with about 450 programmers in all are engaged primarily in developing reference software (for a YeS operating system). In addition, several tens of thousands of people have been drawn to the development of applied software. But they are dispersed throughout various organizations and, because of this, the effectiveness of their work is considerably lowered.

Obviously, it would be sound practice to consolidate these efforts in specialized high-performance organizations which would fill the software orders of computer and automatic systems users in a centralized arrangement.

These measures would make it possible to reduce expenditures on automatic control system development and to increase substantially the efficiency of their use, toward which we are aimed by the resolution of the 25th CPSU Congress.

8945
CSO: 1820

WORK ON CREATION OF COMPUTER NETWORKS TOLD

Riga SOVETSKAYA LATVIYA in Russian 15 Jun 78 p 2

/Article by E. Yakubaytis, vice president of the Academy of Sciences of the Latvian SSR: "Computer Networks"/

/Text/ Computers, which had appeared as devices for complicated mathematical operations, have quickly turned into a universal means of processing information. Having begun its triumphal procession in scientific laboratories, computer technology has encompassed almost all areas of human activity.

The creation of large memories and high-speed computers has led to the appearance of electronic libraries, where the knowledge obtained by humanity over the course of many centuries is quickly being accumulated. The transformation of telephone and telegraph networks into data transmission networks and the appearance of special communications networks for computers open vast possibilities for the fast exchange of information over tremendous distances.

Today, the operation of the national economy, the solution of problems in social development, scientific research, and scientific and technical development require the participation of large collectives located in different institutions, cities and even countries. And this is connected with the quick exchange of information and the implementation of close and dynamic interaction in the management process.

From this there has appeared the sharp necessity for changing over from using a tremendous mass of duplicating data stores to the creation of large-scale specialized electronic banks, access to which would be guaranteed to all users located at any points in our country. In addition, the wide automation of data retrieval and reference operations and the introduction of dialog methods of long-distance interaction with many computers are required.

In connection with the wide application of computers there are also important problems related to the efficient use of them and their optimum loading. The requirement has arisen for machine specialization and an increase in the reliability and accuracy of data processing. Finally, the advisability of converting separate computer centers into a single, multi-machine system for collecting, storing, processing, transmitting and outputting huge volumes of information dispersed across the large area of the Soviet Union has become clear.

All this has demanded that scientific research connected with the creation of new types of computer information systems be conducted. As a result, a wide range of diverse electronic macro-, mini-, and micro-machinery has appeared, a hierarchy of different memories has been created, communications network technology has been developed. and a wide nomenclature of subscriber points is being produced. As a result, the problem that had been posed has been solved through the creation of multi-machine computer networks.

The computer network is an association of a large number of the most diverse (according to type and size) computers located over a huge area and which interact with each other in solving the most varied problems.

The creation of computer networks signifies a quantitative and qualitative change in data processing systems. The volume of computer operations in them (as at the computer centers) continues, as before, to grow. However, purely informational operations not connected with mathematical computations are appearing and growing at an even faster rate. As a result, the possibility is occurring to use an extensive set of services. Most important among them are: information systems (data banks and mathematical programs, reference services, retrieval complexes, data file exchange); dialog systems (the creation of new mathematical programs, machine training services, graphic data processing); logic and computer operations (mathematical calculations, interaction with mathematical models, logical data conversion); electronic mail and telegraph (exchange of documents, diagrams, and drawings, telephone conferences and meetings, accomplishment of joint work by collectives located at considerable distance from each other, provision of massive data, transmission of pages from various newspapers and magazines, the latest news, political and economic surveys, and so forth, the accomplishment of financial and commercial operations).

A most important characteristic of the machines included in the computer network is their specialization for completing specific operations. Thanks to this the load of the machines and the efficiency of their use are increasing. The user, who has an inexpensive and simple subscriber's point (terminal), obtains the possibility at his own place of work to do all the information operations necessary to him for using any of the machines included in the network.

The creation in our country of local computer networks and their subsequent union in a nationwide network has not only economic, but also gre great political significance. Thus, in our country's different scientific organizations research is being conducted that is connected with the architecture of multi-machine associations--a new field of technical cybernetics directly closing in with computer technology. At the progressive limits of this research is the work being done at the Academy of Sciences of the Latvian SSR. Here, a wide complex of scientific research is being conducted in the field of computer networks, in developign methods and means of equipping the machines, in dialog modes of using network resources, etc. Work is going on in close cooperation with many scientific and trade organizations in the Soviet Union, the GDR, Hungary, the United States and a number of other countries.

The theoretical research being done has permitted us to embark upon a number of scientific and technical developments which provide for the combination of electronic machines into computer networks. Experimental communications sessions with computers installed in Moscow, the United States, Belgium, Austria, Italy and France are already being conducted. Trial sessions through communications satellites are going on.

The institutes of the Academy of Sciences of the Latvian SSR are also conducting work related to the creation of an academy-wide experimental computer network (EVS). Its first line is already in experimental operation. It includes twelve interconnected computers installed at these institutes: the physicoenergetics, mechanics of polymers, organic synthesis, the chemistry of wood and electronics and computer technology. In this network, having mini-equipment, it is possible to work with all the other machines and especially with the large electronic ones installed at the laboratory.

The computer network created at the Academy of Sciences of the Latvian SSR is experimental, for it processes architectural decisions, checks machine interaction methods, and creates the apparatus for rapid communications. The developments being worked here will, in the near future, receive wide application in various sectors of the national economy. The first local computer network, the creation of which was embarked upon by scientists at the Academy of Sciences and personnel at the Gosplan of the Latvian SSR, will encompass data processing related to planning in our republic. This network will include machines in the ES EVM /Unified Computer System/, the Simens machine and various types of mini-machines. The creation of this network will permit us to raise the automation of planning to a qualitatively new level. Access to this network from its terminals will be available to all the republic's personnel (within the framework of their competency) whose activity is connected with planning.

The sceintific research being done in the area of the architecture of multi-machine associations permits us to pose the problem of the stagewise creation of a computer network for the Latvian SSR. Its first stage may

be the freely connected network, in which the republic's existing computers from the ES EVM are made into a complete set by program and technical means which permit them to be connected into standard telephone and telegraph networks. Subscriber points installed at institutions, institutes, design bureaus, establishments, etc., can interact with all these machines. Thanks to such a freely connected network the possibility arises to interact with any computer included in this network from any subscriber's point established at the user's place of work along commutation telephone and telegraph networks.

The Institute of Electronics and Computer Technology at the Academy of Sciences of the Latvian SSR, together with the Computer Center at Latvia State University, is completing the development of mathematical programs, while our domestic industry is beginning to manufacture the standard a apparatus needed for this purpose.

However, for the creation of a freely connected computer network in the Latvian SSR, a large volume of work is required that is related above all to the solution of questions like the development of a list and structure of the republic's information banks (for example, planning, statistics, local industrial, agricultural, and other banks), to inventing and install installing the required auxiliary equipment, creating and introducing data banks, training personnel and starting up a large number of subscriber's points. This work requires a great deal of time, making it all the more important to embark upon it as soon as possible.

We should emphasize that the creation of computer networks is a most complicated problem, the solution of which is possible only by means of its integrated working-out by scientists and specialists from the most diverse directions, particularly economists, mathematicians, lawyers, and engineers in different specialized fields. Today, the weight of the work connected with the creation of networks lies in the area of their organization.

As has already been noted, in the future computer networks will become a single system, distributed across the whole Soviet Union, for the accumulation, storage, transmission, processing, and output of data in all areas of social development and economic activity, including science, education, health, and so forth. These networks will interconnect computers installed over the entire country and will also take upon themselves all of the information that today is being transmitted by television, telephone, and telegraph communications networks.

The creation of computer networks will permit us to bring the automation of operations in the management of the national economy, its sectors and establishments, to a qualitatively new level, which provides for the solution of the most complex social and economic problems.

9223
CSO: 1870

'ARITMA' ELECTRONIC MICROSTRUCTURE TESTING AND ANALYSIS COMBINATION DESCRIBED

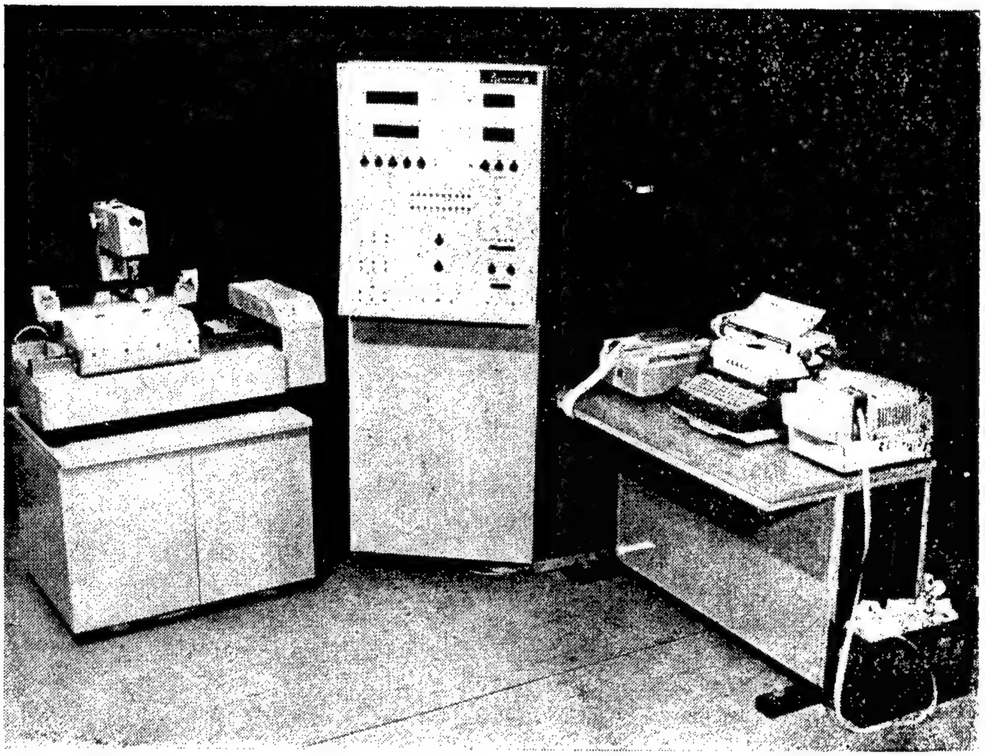
Minsk PROMYSHLENNOST' BELORUSSII in Russian No 3, 1978 p 26

[Article by Yu. Biyenko, candidate in technical sciences, and L. Pavlov, Belorussian SSR Academy of Sciences junior scientific associate: "The 'Aritma' Complex"]

[Text] As we know, the production cost of the majority of electronic instruments manufactured in which are employed quasi-periodic and functionally varying microstructures is not low. In addition, production rejects number very high. In order to reduce the percentage of rejects it is necessary to obtain, process and store flows of information characterizing the state of test microstructures at hundreds and thousands of points. It is impossible to do this by employing general-purpose measuring microscopes and field-emission microscopes. To our assistance has come the "Aritma" computing and measuring complex (in photograph), created at the Belorussian SSR Academy of Sciences Institute of Electronics on the basis of mathematical methods, cybernetics and computer hardware. In it are employed precision photoelectric laser devices for checking the geometry of quasi-periodic microstructures with automatic efficient statistical analysis of the results obtained. The accuracy of measurements has grown considerably because of a specially developed noncontact unit for information throughput, designed with aerostatic guides. Laser scanning of objects is accomplished by means of an online magnetic d.c. motor. A laser interferometer is employed as a linear displacement detector. The efficiency of the complex is high, since periodic structures are checked continuously. An operating analysis of the information obtained is made automatically.

The "Aritma" equipment combination makes it possible to measure, check and analyze microstructures at key stages in the technological process of their manufacture. The savings from employing only one "Aritma" complex is more than 600,000 rubles.

A working complex was demonstrated at the USSR VDNKh [Exhibition of Economic Achievements]. It was awarded a first prize and a silver and three bronze medals.



The engineering and scientific principles incorporated in it have been protected by two patents.

8831
CSO: 1870

BELORUSSIAN SSR AUTOMATED CONTROL SYSTEM FOR LOCAL INDUSTRY, STATUS REPORTED

Minsk PROMYSHLENNOST' BELORUSSII in Russian No 3, 1978 pp 48-50

[Article by A. Simonovich, department head, Belorussian SSR Ministry of Local Industry Main Computing Center: "Industrial Automated Control System"]

[Text] By the end of the 10th Five-Year Plan period the total output of local industry will have increased 35.5 percent. The output of consumer goods will develop at an especially rapid rate. For example, the output of enameled steel cooking ware, musical instruments, hardware and Christmas tree decorations will increase by a factor of 1.5 to 1.7, and of pottery fourfold. In the next few years production will be mastered for more than 1100 different new types of products. The goal has also been set of drastically raising the technical level and of making wider use of production byproducts and local raw material and materials.

Experience in the operation of local industry speaks for the fact that an increase in total output and complication of interrelationships between enterprises will result in a considerable increase in information flows. The information today, for example, already surpasses human capability. There is therefore required a radical restructuring of the organization of the work of engineering and technical personnel. Solving this problem by increasing their number is already impossible in the present situation. The way out of the situation is to introduce automated control systems. That is, ASU's [automated control systems] bring about a change in the structure of expenditure of work time on the part of engineering and technical personnel, along the line of increasing the percentage of it which is of a creative nature. Here there is a change in methods of working and in problem solving techniques. There arise new forms of interrelationships between people and information processing equipment. And there is one more important point. Including state-of-the-art technology in the engineering work process and segregating and shifting over human mechanical functions to it create the needed economic prerequisites for freeing a percentage of workers from the area of engineering operations.

How are things going with introduction of an industrial automated control system under conditions of local industry? Let us say right off that many problems have already been solved. A Main Computing Center (GVTs) for Local

Industry has been created, which has been given the functions of the head organization for developing and introducing automated control systems. A YeS-1020 computer has been installed. Methodological materials have been developed for setting up and examining a system for planning, reporting and control at enterprises and in organizations.

The chief designer of the OASU [industrial ASU] for this economic sector (the minister of local industry) has headed up an operations group whose job it is to solve routine problems and execute a unified methodological approach. This operations group is made up of heads of the ministry's divisions and of directors of the GVTs, who are responsible for developing the system. The main performer of the work is the Belorussian SSR MMP [Ministry of Local Industry] GVTs.

The OASU for local industry, with its diversity of information flows, is in the form of a multilevel hierarchical control system. To control its development means to foresee the course of events. Certainly an OASU, as practice has shown, results in maximum savings only when it is based on a foundation of automated systems for controlling enterprises. Taking this fact into account, we will conduct in parallel the development of automated control systems for all three control levels (ministry, oblast administration and enterprise). The ministry, as the customer for the OASU, and the main computing center, as its chief developer, have been given the task of determining the main guidelines for creation of these systems. Most important here is the selection of the basic projects for creation of ASU's. In question here is the fact that the republic's local industry is represented mainly by small and medium-size enterprises. For example, the percentage of small enterprises is 71.4. More than 30 percent of enterprises do not have special-purpose design and technology subdivisions. Their functions are performed at 60 percent by individuals or by not too large groups, which number no more than one to three people. For this reason a solution has been hampered to the problem of steady replacement of the assortment of manufactured products to meet the requirements of the demand.

Therefore, in preparing for the introduction of the OASU, the ministry and oblast administrations have first taken the necessary measures aimed at subsequent specialization in terms of subject matter and technology, at consolidation of enterprises, and at setting up production associations. Plans have been made to create 15 new production associations and to consolidate 20 industrial enterprises. As a result, there will be in operation 22 production associations and 24 consolidated and 88 independent enterprises. Concentration of production, specialization and consolidation of enterprises, and creation of production associations will make it possible more fully to realize the opportunities for economic reform and to achieve a significant increase in the efficiency of engineering work and, on this basis, acceleration of scientific and technological progress in the sector. Implementation of these measures will make it possible to concentrate the production of machine building products at 23 enterprises instead of 41, of woodworking products at 43 instead of 82, and of light industry products at 40 instead of 64.

The creation of production associations and the concentration and specialization of production are, as we know, of decisive importance in the matter of raising the effectiveness of production control. It is bad, however, that in solving this problem consideration is not given to questions relating to the content of functions of the control apparatus, to their centralization or decentralization, to the conditions for forming structural subdivisions, and to the opportunities for employing standard structures. Also not being treated are problems relating to the concentration of nonindustrial organizations and to the unification of scientific and technical thought. Let us take, for example, the Belorussian Planning and Technological Institute of Local Industry. Of the total amount of work done by it in 1977 developments for local industry amounted to a total of only 65 percent. On the other hand, the Belorussian SSR MMP GVTs is doing work on six topics. Seventeen problems of the 40 called for by the technical quota for creation of the OASU have been put into service in industry. Problems for the first phase of the OASU have been marked for being put into service in industry during the present year. The plan's project calls for the development of 49 problem formulations for six topics and the development of software for 56 problems. Of course the small team at the GVTs does not have the manpower to do this amount of work in time.

On the topic list for work being done by the Belmestpromproyekt Institute [Belorussian Planning and Technological Institute of Local Industry], the GVTs, and the NOT [scientific organization of labor] and UP [control processes] laboratory are developments which are close in terms of content. Unfortunately, they are being carried out without taking into account the employment of computer technology. For the purpose of eliminating parallelism and the duplication of work, of concentrating specialists in the most important production sections, of introducing a unified technical policy in the system for local industry, of achieving a maximum workload for the computer equipment available, and of increasing the return on investment in its utilization, the time has come when it is necessary to join the Belmestpromproyekt Institute, the GVTs, and the NOT and UP laboratory together into a single industrial institute of local industry. This will make it possible to centralize control functions, to ensure rapid technological process, and to make better and fuller use of all available resources.

Because of the fact that there is a predominance of small enterprises in this sector, a substantiated choice of projects for automation is needed. In our opinion, it is advisable economically to develop ASU's for enterprises located in cities such as Gomel', Mogilev, Vitebsk and Borisov. In these cities are concentrated enterprises representing the most important branches of local industry. Here it makes sense to build collective computing and information centers.

The development of automated control systems for enterprises of different branches of industry and for oblast local industry administrations in these cities will make it possible in the future to circulate design solutions to other enterprises of related branches of local industry, to make better use of

accumulated knowhow, to avoid many mistakes, and to reduce the time required to put systems into service. There is subsequently the opportunity to concentrate at multiple user computing centers the solution of control problems for a number of enterprises under the jurisdiction of oblast local industry administrations. Representing a plus is the solution of the problem of tying in several administrations and enterprises of local industry to the network of computing centers created by other ministries or departments in the republic. In our opinion, under this heading can be placed enterprises and administrations located in Grodno and Brest.

The solution of control problems for the ministry, the Minsk Oblast Local Industry Administration, the arts industry administration, and enterprises located in Minsk must be concentrated at the Belorussian SSR Ministry of Local Industry Main Computing and Information Center. Thus, proposed on the one hand is the creation of its own multiple user computing and information center, and on the other substantiation and referencing of plans for mechanization and automation of economic and engineering and technical problems of control to the network of computing centers created by other ministries, departments and large enterprises in the republic. Attachment to the IVTs's [computing and information centers] of several enterprises and organizations creates the prerequisites for better utilization of the available control equipment and for a savings in operating costs and in capital for building areas for computing centers.

The creation and functioning of the ASU depends on timely and high-quality enactment of preparatory measures. Deserving special attention here is the training of personnel and of specialists in computer processing of information. In order to accelerate this process, enterprises and organizations of local industry must emerge in two guises--as customers for the system and as participants in its development. The participation of leading specialists from enterprises and organizations in the creation of ASU projects and, in particular, in the formulation and algorithmization of control problems and in the development of forms of primary documentation and of standard accounting will have the effect of good training for control personnel. The concluding stage in the training of control personnel for the ASU should be their participation in the development of regulations for functional divisions of the control apparatus and of service instructions. Altering of the structure of the control apparatus and introduction of regulations and instructions at the first stage of introducing ASU's for enterprises will make it possible to lessen the discrepancy between former and new requirements for control personnel.

A hindrance to the work and consequently to the implementation of OASU problems in industry, is also the state of standardized accounting, and, in particular, of the finished product classifier. Not a few other loose ends can be cited. The solution to the problems touched upon will make it possible to raise control to a new higher level.

8831
CSO: 1870

AUTOMATED CONTROL SYSTEM DISCUSSION CONTINUED

Moscow EKONOMICHESKAYA GAZETA in Russian No 29, Jul 78 p 17

[Article by N.P. Lebedinskiy, deputy chairman of USSR Gosplan: "Automated System of Planning Computations"]

[Text] We are continuing to publish articles on the materials of the 2d All-Union Conference on the Use of Computers and Automated Control Systems in the National Economy (the preceding articles were published in Nos 22-26 of the weekly).

The present development of the national economy is characterized by high rates of technical progress, tremendous production scales, continual changes in its structure and distribution and complex intrasectorial and intersectorial economic relations. Increasing the efficiency of social production under these conditions requires a further improvement in the systems of planning and administering the national economy in all units.

The requirements for improving the planning have been reflected in the work done by USSR Gosplan and the union republic gosplans in conjunction with the scientific research institutes on planning and putting into practical work in planning an automated system of planning computations (ASPR).

In Consideration of the Comprehensive National Economic Programs

ASPR is a system of working out national economic plans and monitoring their fulfillment under the conditions of widescale use of economic-mathematical methods and computers.

Taking part in the development and design of the automated system of planning computations are over 140 different scientific research and planning organizations, including all the institutes of USSR Gosplan and the union republic gosplans, the economic institutes of the USSR Academy of Sciences, and also many sectorial scientific research and planning institutes of the ministries and departments.

The concept of ASPR has now been worked out. The first section of the system has already been turned over for operation. The storehouse of planning has been substantially enriched by new methods and processes of calculations and the scientific substantiation and balanced nature of the plans has been increased. Today, without ASPR, based on widescale use of economic and mathematical methods and the electronic computer, it is difficult to imagine the possibility of practical implementation of measures to improve planning. Moreover, without ASPR the drafting of many sections of current and long-range plans is now unthinkable. This system has become firmly entrenched in the industrial process of planning.

The draft of ASPR is the summarizing document in which is formulated the concept of the system as a program of comprehensive execution of the basic directions of improving national economic planning on the basis of modern methods of data processing. It includes the most important, interrelated planning designs for creating all the ASPR subsystems on the basis of provisions, unified in principle, for the construction and functioning of the system as a whole.

In developing ASPR, great importance is ascribed to intensifying the comprehensive approach to the consolidated, sectorial and territorial planning on the all-state level and closer coordination of sectorial and territorial plans.

The national economic programs will be an important part of the plan from the standpoint of its content. They are a new form of organizing the solution to socio-economic problems and putting into practice the results achieved from scientific-technical progress. Since the programs are worked out to solve the most important problems of the country's socio-economic development, they will have priority over the nonprogrammed part of the plan in allotting resources in consideration of observing the requirements of balance in the development of the economic system as a whole.

The combination of the basic goals in the development of all of society with the problems of developing the sectors of the union republics and major economic regions and ensuring concentration of resources to solve extremely important economic and social problems in the comprehensive programs predetermine the need to single out one more thing--the programmed cross section of the national economic plan and its integral coordination with the sectorial and territorial cross sections.

ASPR reflects the results of the work done by the planning organs on further improving the system of planning indicators in order to intensify their role in stimulating increased efficiency and higher quality in various economic units, harmonious combination of the interests of individual workers and collectives with the general national interests, fuller use of all the potentials and adoption of stepped-up planning assignments.

Carrying out these directions in improving national economic planning, which have been reflected in the planning developments of ASPR and work on putting the elements of the system into operation, makes it possible to considerably increase the scientific substantiation and quality of our plans.

Problems of the First Section of ASPR

Along with solving the theoretical problems of improving planning that are contained in the draft materials of ASPR, the first section of the system provides for the solution of over 3,300 planning problems introduced into the practical work of planning in USSR Gosplan and the union republic gosplans, including 1,100 problems at the level of USSR Gosplan.

Among the problems of the first section of ASPR, direct planning computations are the most widely represented.

Performing these computations on an electronic computer makes it possible to utilize more broadly the advantages of the normative method in determining the demands for physical resources for production and capital construction, at the same time ensuring a rise in the level of substantiation and balance of the plans. For example, with the aid of the electronic computer included in the first section of ASPR of USSR Gosplan, centralized computations of the demand for materials for the machine building output are made for 9000 types of machines, while formerly, without the electronic computer, they were made for only 600 types. At the same time, considerable work has been done on the formation and substantiation of a normative base, for which about 270,000 norms for consumption of materials have been introduced in the electronic computer and are constantly being updated in the process of working out the yearly plans. It would have been practically impossible to make such computations without the use of electronic computers.

Using electronic computers made it possible for USSR Gosplan to make, in addition, estimates of the demand for metal to produce precast reinforced concrete, monolithic reinforced concrete, manufacture metal structures and other purposes, which was not done under the conditions of the planning technology used earlier. Without increasing the staffs of the corresponding subdivisions, USSR Gosplan is now doing an additional amount of work on determining the demand for metal of over 30 of the largest construction projects and facilities (KamAZ, Atommash, Sayano-Shushenskaya GES, facilities for the Olympic Games and others).

In addition, carrying out direct planning computations on the electronic computer made it possible to ensure the necessary precision and reliability of the planning documents and raise the labor productivity of the planning workers considerably. USSR Gosplan specialists have obtained the opportunity of paying more attention to economic analysis and substantion of the planning decisions.

In the work of the divisions of USSR Gosplan on the draft of the national economic plan for 1978, automated computations were made of the consolidated plans for industrial production and capital investments, the plans for the development of domestic trade, plans for labor and personnel, contracting and planning and research work and the basic indicators of the draft of the plan in territorial cross section. As a result, over half the volume of all the materials for the drafts of the yearly State plan for the economic and social development of the USSR in 1978 were formed and issued in the machine version.

The most promising from the standpoint of raising the quality and efficiency of the national economic plans are the problems solved by using economic-mathematical models. These problems, of course, may be solved only with the use of the electronic computer.

Using models of the intersectorial balance makes it possible, at the initial stage of drafting the plan, to fulfill in shorter periods a large number of variants of the calculations when determining the rates and proportions of development of the national economy. This, in turn, makes it possible to estimate more precisely the different drafts of the plan for the socio-economic development for the future and to study in more detail the effect of the planned indicators of efficiency of individual sectors (materials-intensiveness, capital-output ratio, labor-intensiveness and others) on the growth of social production and satisfaction of the ultimate social needs. Such calculations were performed for the first time in drafting the plan for 1976-1980, and are now being used in drafting the plan for the Fundamental Directions of the Economic and Social Development of the USSR for the period up to 1990.

Introducing models of optimization of the development and distribution of production for the complexes of the sectors, individual sectors and production facilities makes it possible to reveal the best type of specialization for enterprises, and to select, out of all the possible variants of renovation of existing enterprises and construction of new ones, those that will be able to ensure the most complete satisfaction of the national economic demands with the least labor, materials and financial input.

The use of economic-mathematical models in drafting the plans for development and distribution of sectors and production gives a substantial economic effect, constituting hundreds of millions of rubles for the national economy.

Perspectives for the Development of the System

Experience in developing and introducing the first section of the automated system of planning computations makes it possible to determine more clearly the perspectives for the further development of the system, especially of the second section, which is slated to be put into operation by elements in 1978-1985.

The main attention is being paid not only to increasing the number of problems solved, but also to achieving their best coordination with the computations introduced into the first section, increasing their complexity on the basis of improving the all-system devices of ASPR, especially the methodological, informational, mathematical, technical and technological software.

No less important a point should be the development and efficient use of an automated data bank which is being designed on the basis of the domestic electronic computer of the third generation of the unified Ryad series, with the simultaneous development of a broad network of terminal equipment and mini-computers, which will make it possible to set up a dialogue mode of work for computer specialists.

Within the context of designing the second section of the system there must be practical working out of the interaction between the USSR Gosplan ASPR and the automated system of state statistics of the USSR Central Statistical Administration, the USSR Gossnab ASU, the USSR Ministry of Light Industry ASU, the Ministry of Instrument Making, Automation Equipment and Control Systems ASU and the Ministry of Foreign Trade ASU.

To carry out these directions in the development of ASPR within the context of the second section, a number of methodological, technical and organizational problems must be solved. First of all, there should be acceleration of the development of the concept of the all-state automated system of gathering and processing information for accounting, planning and administration of the national economy (OGAS). The linking of the automated control systems within the context of OGAS inevitably requires further precision in the nature of the interaction and possibly also the fulfillment of certain additional functions by a number of state organs. These problems absolutely must be solved in consideration of the basic directions of improving the entire national economic administration system.

The state and perspectives for development of the hardware of ASU cannot help but arouse serious concern. The principal shortcomings in the hardware of the second section of ASPR and other automated system, in our opinion, are, particularly, the limited list of parts for the electronic computers produced by industry, which narrows the field of their application and reduces the efficiency of their use when making the necessary calculations. The organization of centralized technical service for the electronic computers is still far from ideal, and this, in turn, reduces the reliability of their work.

There is already an urgent need to work out unified principles for designing and introducing automated control systems. Moreover, these principles, in our opinion, should be worked out with the decisive role of ASPR, ASGS and other systems designed for the central administration organs.

For a substantial increase in the efficiency of the planning and functioning of the automated systems, it would appear, it would be necessary to work out

a comprehensive, specific long-term program (up to 1990) for improving the planning and administration system, using automated systems.

Finally, in order to ensure the methodological and organizational unity of the automated control systems designed in the country, it would be expedient to orient this process toward the elaboration of the automated systems of planning computations made by USSR Gosplan and the union republic gosplans, called upon to be the central unit in the all-state system of gathering and processing data for accounting, planning and administering the national economy.

12151
CSO: 1820

SCIENTISTS INTERVIEWED ON ENGINEERING PSYCHOLOGY

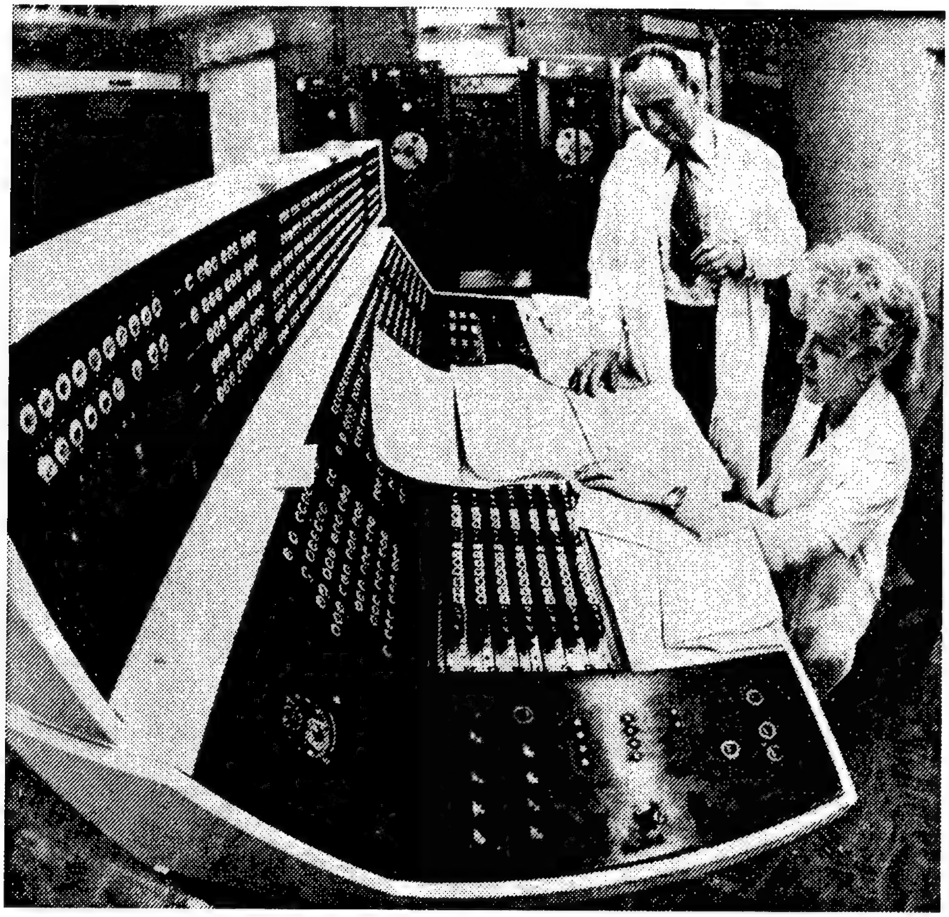
Moscow NEDELYA in Russian No 25, 19-25 Jun 78 pp 2-3, 10-11

[Interview of scientists by N. Lazareva: "From Machine to Man"]

[Text] The advances of cybernetics are widely used today. Modern man lives in a world of technology, created by his labor and intelligence. How is this world adapted to the daily needs of people, how is it possible using cybernetics to create the best working conditions and make our daily life more comfortable? This was the subject of the discussion at NEDELYA's round-table. Taking part in the talk were Prof I. Prangishvili, deputy director of the Institute of Control Problems of the USSR Academy of Sciences and the Ministry of Instrument Building, Automation Equipment and Control Systems (Minpribor); Doctor of Psychological Sciences Yu. Zabrodin, deputy director of the Institute of Psychology of the USSR Academy of Sciences; Professors Ye. Markova and D. Chernavskiy. Despite the different fields of science, the representatives of which are these scientists, they are unified by a common goal--to find the key to the use of modern cybernetic devices from basically new positions. The psychologist began the conversation.

[Zabrodin] Engineering psychology was born at the junction of traditional psychology, occupied with the study of the human personality, and purely engineering design developments. In recent years this discipline has been used more and more for the solution of practical problems, and at the same time it is serving as an intermediary, joining along with the psychology methods, also technical, mathematical and cybernetic methods of research.

The tools of production, the machines, are becoming more and more complex, more "intellectual," if we can call them that. They can recognize



In the laboratory of cybernetics of the Institute imeni Vishnevskiy: the head of the laboratory Doctor of Technical Sciences Prof M. Bykhovskiy and senior engineer A. Kurochkina are analyzing the results of an experiment on the M-220

situations, solve problems, help when organizing research, in the control of technological processes and systems themselves. Special relations arise between man and the tools of his labor, the psychological "man--machine" problem appears.

Engineering psychology helps to use knowledge about man when planning modern computer systems. This science studies the specifics of the information interactions of man and machine. It is known that man perceives and processes information with limited speed. This speed changes greatly depending on the problems man is solving, on his condition, on his individual peculiarities, on his mood. When designing a machine, the designer should know precisely what volume of information about a given object to be controlled a man can process

in a certain period of time. An information overload is dangerous--a man, not being able to process it, will make errors, he will evaluate the situation incorrectly.

[Prangishvili] Is it possible to make machines which evaluate the psychological state of the operator? His mood? Whether, as we say popularly, he is "in good form" or not?

[Zabrodin] Plans for such systems, which would adapt to man's moods, are being developed, but it is necessary even now to evaluate correctly the person's state in order to change opportunely the nature of control of the system.

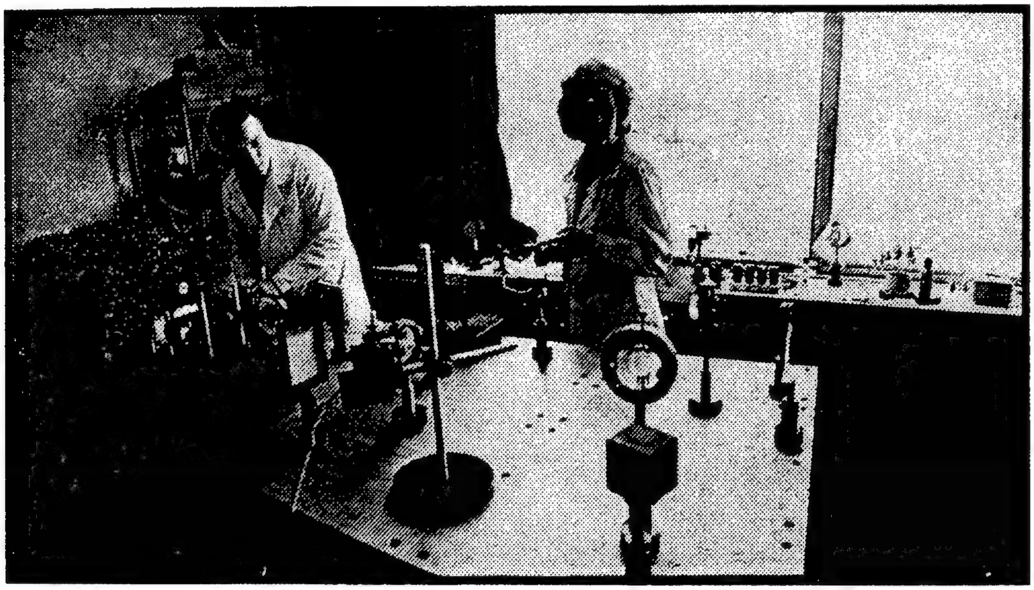
[NEDELYA] Apparently, it is namely from you that the designers should receive this type of knowledge about man and immediately plug it in to the planned systems.

[Zabrodin] Correct. However a serious hindrance is the problem of a common, interdisciplinary language. Now even the technical terms for the very same object, under the very same conditions, but in various fields some times have a different meaning, not even talking about such different fields as engineering and psychology! When planning it is very difficult to formulate the demands on the system, to select the technical means of transmitting information and the control organs, correlated with the potentials of man's mind, coordinated with the actuating organs--with the hands and the feet.

The utilization of cybernetic devices has predetermined an acute need to investigate the potentials of the human intellect. The relation between the development of the "intellectual abilities" of the machine and the thinking of man employed in man-machine systems has already been described, their similarity and difference have been shown. There even exist forecasts of how there will be an increase in the load on the brain, on man's psyche during the creation of "thinking" machines in 10, 20 or 30 years. Now science has has been directed at a search for additional potentials of the human organism. It is known, for instance, that information can enter our brain through the skin considerably earlier than through the eyes and ears. And engineering psychology is developing this channel. Or for instance, there are the biocurrents produced by the organism of man: using them, it is possible to control even a rather complex technical system.

[NEDELYA] What if you look into the distant future? How does it appear in light of all you have said?

[Zabrodin] I am inclined to think that in the future the leading role will be occupied by semiautomatic systems. Why? Well, first of all it is extremely difficult to create ideal automatons, which would fully replace man, and in general it is not necessary. In addition, if you



Adjustment of an optic system of an associative holographic process being performed by junior scientific associate A. Krasnov and senior engineer L. Porokh

create too many complicated complexes, the price of human error in them will grow immeasurably. Third: even having a gigantic number of automatic machines, man still has to control these automatons, but in this case the center of control and the object of control will be more and more re oved from man. Consequently, in order normally to distribute the functions, to lighten the labor and reduce the potential source of errors, it is necessary to follow the path of creating semiautomatic, that is automated systems. And they will be able to take on a lot.

[Markova] All this concerns the fundamental problems of cybernetics--the problems of structure, of optimum autonomy, of optimum communication. But how will psychologists solve the problem of hardware?

[Zabrodin] Any kind of hardware advances a well-known psychological barrier before man. It is one thing when you talk with a secretary, and a completely different thing when you talk with an automaton. The channels of direct, lively contact between people are weakened. And this factor can have serious sociopsychological consequences, including negative ones. This problem, obviously, should be solved by the psychologists first of all.

[NEDELYA] Yelena Vladimirovna, you are engaged in such a new field of cybernetics as the planning of an experiment. Can you explain what this is? Are your investigations being incorporated in practice?

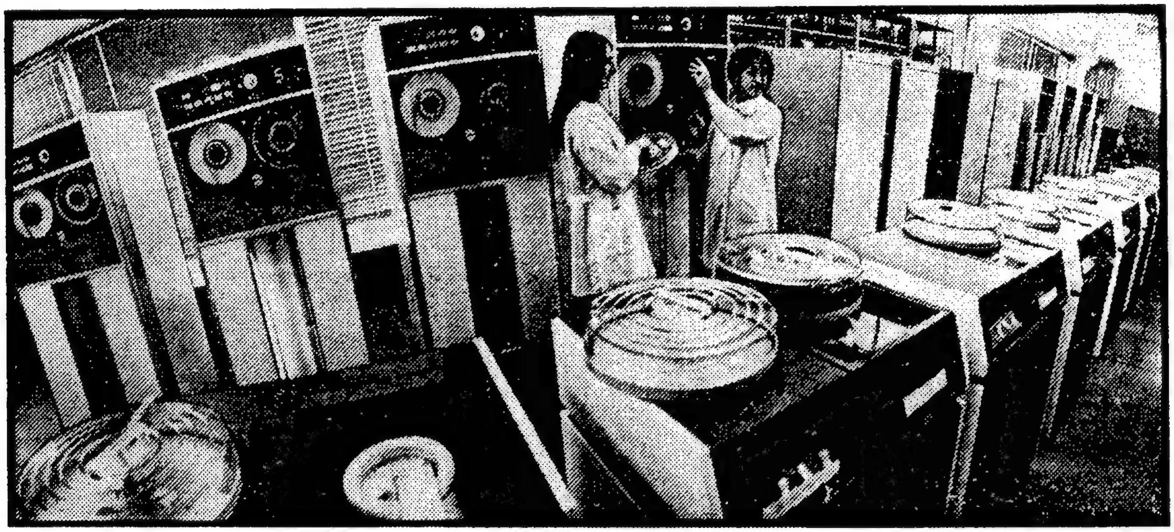
[Markova] This is truly a new discipline. It goal is to improve the very process of experimenting, to control it using an electronic computer. It is a matter of optimum set up of multifactor experiments with the study of complex objects and processes, such, for instance, as the study of the effectiveness of new varieties of seeds with nonuniform soil, synthesis of new drugs, catalysts, and so on. The beginning of the mathematical theory of the experiment goes back to 1919. The English statistician Ronald Fisher was the first to use at the Rotemted Agricultural Station the method of multifactor experiment which set up experiments according to a mathematically based plan. These works have attracted the attention of cyberneticians. Today the complexity of objects of research is increasing immeasurably and a new approach is necessary.

As is known, during planning, problem number one is reduction of the number of experiments. Nevertheless this cannot be done arbitrarily: too much information is lost. In order to facilitate this task, special reduction algorithms have been developed, based on mathematical calculations.

I will cite the simplest example, when only the essentials are sifted out and segregated in an experiment. Such was the well-known group screening experiment by Dorfman, performed in the United States at the beginning of the Second World War. Every soldier called up for the army was obliged to give blood for analysis. In order to save time, Dorfman proposed the idea of group study of the blood. The recruits were put into groups of several dozen people. A study was made not of the blood of each one individually, but according to the group. If in the group analysis everything proved to be fine, repeated studies were not made. But, with a deviation from the norm, all the participants in the group were studied individually. Such methods are also used in technical control. In order, for instance, not to check all the parts of integrated circuits, in radioelectronics and electrical engineering a group of parts is checked. Then in that group where a defect signal arises, each element is examined individually.

[Prangishvili] How is an experimental search made, well, let us say, for new complex materials? Is it possible even here to organize the process in an optimum way?

[Markova] This, of course, is complicated. But it is surmountable. Indeed new material with given properties means first of all an extended search. What this material should consist of is not known, since it is new. The experimenter investigates a collection of various fillers, stabilizers, plasticizers, and so on. Each group is presented in a set. And the experiments should be conducted under varied temperatures and other conditions. When planning such an experiment, it is possible to make use of the special method of reduction of the sorting of variants.



In the Computer Center of the Institute of Control Problems, USSR Academy of Sciences

[NEDELYA] It seems there is no area either in science or in industry where the planning of an experiment would not find application.

[Markova] You are correct. I personally know hundreds of projects which have yielded very good results and a large saving, particularly in the chemical industry, in the production of plastics...

[NEDELYA] I would like to know, what medicine "thinks."

[Chernavskiy] The planning of experiments in the field of medicine suggests to us the so-called "blind method." A physician must study a medicine, its results, without knowing the patient, without seeing him! How can this be? These are fundamental difficulties. Still more work must be done; in medicine everything is manifested much more acutely. It seems to me that it is difficult to apply the "blind method" in medical practice. In brief, there are fields where with the existing recommendations it is still early for cybernetics to appear.

[Markova] Permit me to express my opinion. Where there is an experiment, there is the science of planning its conduct. But, unfortunately, far from everyone is acquainted with these methods. Hence there are all kinds of incorrect judgements. The planning of an experiment is a developing trend, we are finding out all its new possibilities in the "service" of increasingly complex objects.

[Prangishvili] The field of management is inconceivable without the use of computer equipment. This is obvious. However, in recent years an untraditional direction has appeared in the development of this

equipment. In the opinion of scientists, this direction may lead to quality changes in data processing and in the field of management, in organizational structures and in economics--that is, in the system of management in the broad sense of this word.

What are the untraditional methods?

First: the use of microprocessors and microcomputers for data processing and construction of control systems. Second: the creation of multi-process computers, possessing high speed and productivity, on the one hand, and reliability and vitality, on the other hand. And, finally, the third thing: the creation of computers of a fourth generation, utilizing the principles of training and adaptation even with an element of artificial intellect. These are the three "runners" of cybernetics, which, in our view, are the basis of future control systems. They are being developed and are already beginning to be incorporated into engineering practice.

[NEDELYA] Could you explain what is microprocessor equipment?

[Prangishvili] Today in one crystal it is possible to place a computer--a microelectronic computer. There has been a change in the very ideology of building computers and control systems. The systems have been built on simple and reliable large integrated circuits, which allows us to solve in a new way the problem of control.

I will explain with an example. Third generation computers were built so that utilized in the majority during control of a process were greatly centralized principles of control. All the commands came out of this machine. The appearance of inexpensive microprocessors and microelectronic computers the size of a suitcase of the "diplomat" type and even smaller is changing the very ideology of control and is making expedient a transition from centralized to decentralized or distributed systems of control.

It is more preferable now not to create one large machine and carry out the control of technological processes from it, but to have microcomputers near each objective and process the data on the site. The reliability of control, and the reaction speed of the system are being increased. The system is less cumbersome. And so on.

The new step in cybernetics is the use of microcomputers for personal and home use. When the machines were huge, who could even think of having an electronic computer at home? Now microcomputers or apartment terminals are beginning to play what is not their last role in everyday life. I am convinced that in the not-distant future the appearance of the equipment for personal use will have greater social consequences than even the appearance at one time of telephones, radios and television sets.

[NEDELYA] Or course it is very nice to have a small electronic computer at home, but, apparently, its use will be very limited.

[Prangishvili] Don't say so. I happened to see such machines in America, and in Japan. The use of personal microcomputers or terminals will have a strong influence on the ideology of teaching schoolchildren, students, and the preparation of teachers for lectures. Such machines already make it possible to proceed to programmed teaching. Householders are resorting to the assistance of the micromachines for managing the household or even for compiling the dinner and supper menus.

Now in many countries there is a passion for at-home video-games. A small electronic computer is comparatively inexpensive and is hooked up with a television set. In a microregion there are 6-7 programs for several games. You press a button and begin to play the game. If you are bored, you switch in to another program. This fascinates the adults, and it gives children additional knowledge, it teaches rapid reaction and logic of thinking. Such electronic accessories to the television set for different video games have begun to be produced even in our country.

[Markova] Apparently, with the aid of microprocessor systems it will be possible to solve many domestic problems. It would be interesting to introduce this equipment in regional polyclinics, the trade network, and even in many other spheres of our everyday life.

[Prangishvili] It is probable that this will happen ultimately.

[Zabrodin] All this will engender new psychological problems. What will be the consequences of man's ever-growing isolation in this case, his encirclement with an artifically created world? Indeed, in creating all this at-home cybernetics, we get further away from real interaction, and the intellectual functions peculiar to the human mind are given by us to a machine.

And there is another thing in the interaction between man and machine--the problem of language, of dialogue, the ability to communicate with it. What will we do in this case? So far we do not have very many programs which operate in our natural language. The mathematical language of interaction can be composed excellently, but linguistically it is very poor. There is one way out: either our programmers must be polyglots, or we must build such special systems of translators, of interpreters, which will insure the possibility of more or less natural "interaction."

[Chernavskiy] A just remark. In the field of medical cybernetics this is no less perceptible. With regard to biology and medicine, here the task of cybernetics consists in utilizing the rich experience of

mathematics and physics. Now biology has come up against the problem of regulation. Whereas several years ago basically the problem was solved as it was set up, now important is for what and how to regulate. Here there arises a task--to join the rich experience, erudition and intuition of biologists with the advances of cybernetics. Let us take even such a frightful phenomenon as fibrillation of the heart. It consists in that the coordinated waves controlling the heart suddenly become chaotic, causing trembling of the heart muscle. What does this come from? This question bothered everyone for a long time, until a mathematical model was created, and then the possibility appeared not only of recognizing these phenomena ahead of time, but also of finding optimum ways of positively affecting them.

I can tell about the use of yet another model. This is closer to oncology. There is no argument--cancer is a serious disease. But most often people die not from the cancer, but from disturbance of the regulation of the organism, caused by the malignant tumor. Unfortunately, there are frequently cases when, trying to cure and eliminate the tumor itself, lost from sight are those changes which are occurring in the organism as a whole. The need has arisen to be able to link together the picture of the interaction of the tumor with the organism. It is impossible to do this without cybernetics.

[Prangishvili] Honestly speaking, I cannot imagine how it is possible to simulate such a complex process, where all the indicators are based on physical and psychological sensations of the patient.

[Chernavskiy] You are right, the very process of creation of the model is difficult to formalize. It is necessary not only (and not so much) to know mathematics and computer technology, but also the physico-chemical bases of the object to be simulated. As a rule, good models arise in the close cooperation of various specialists.

[NEDELYA] What do you think, will this direction of cybernetics be developed in the future?

[Chernavskiy] I have specific dreams: to find a common language between biologists, mathematicians and engineers. Language is the basis of mutual understanding. The second thing is the introduction of mathematical models in medical practice. Models are needed that are sufficiently simple and at the same time effective, containing a visible number of parameters and easy to handle. It is necessary to develop and improve computer equipment, it is necessary to give the clinical physicians the opportunity to "play" with the model: to pose a question to it and immediately receive an answer.

I hope that in the near future physicians, armed with the knowledge, experience and advances of cybernetics and machine diagnostics, will be able to declare: there are no incurable diseases!

[NEDELYA] It is difficult to believe in this!

[Chernavskiy] Why is it? Humanity has already freed itself of many diseases, and it will deal with them once and for all, but, very likely, without the cybernetic approach it will be difficult to do this.

10908
CSO: 1870

TEN YEARS OF WORK ON ELECTRONIC EQUIPMENT FOR THE INTERKOSMOS PROGRAM BY TESLA

Prague REVUE OBCHODU /PRUMYSLU/ HOSPODARSTVI in Czech No 5, 1978 pp 12-15

[Article by Eng Vaclav Grim, TESLA, A.S. Popov Research Institute for Communications Technology]

[Text] The program designed to explore outer space by means of satellites, directed by the Interkosmos organization, offers scientific centers of participating countries great opportunities for involvement in this field of research. Its importance lies in the possibility of concentrating all efforts and means on the building of scientific apparatus for individual measurement tasks and then gradually perfecting them while the operation of the satellites from their lift-off into orbit until the completion of the observations is taken care of by the USSR. The placing of instruments in satellites makes possible a manyfold multiplication of the discriminatory power of the instruments and of the ability to discover the relationships existing between phenomena observed on the earth, the sun and the rest of the universe.

A number of electronic devices are used in making measurements, transmitting information between the satellite and stations on earth and in directing the operation of satellites. This area of research is unthinkable without electronics. Therefore, a number of Czechoslovak scientific centers is expanding their electronic departments and relying on the Czechoslovak electronics industry and its research institutes. Soon after 1967, when the agreement was reached to establish the international organization Interkosmos, cooperation was initiated in this field of research between the institutes of the Czechoslovak Academy of Sciences and the USSR Academy of Sciences. The first requests reaching VHJ TESLA and specificically the A.S. Popov Research Institute for Communications Technology were to find solutions for a number of electronic instruments for these purposes. Because of the stringent demands placed on reliability, climatic resistance, resistance to vibration, minimum consumption of power and the small size and weight of the instruments, the fulfillment of these tasks involves also the need to solve some very difficult problems. All this is part of the overall need to assure further development of electronics.

Cooperation with other centers in installing instruments on the flight deck of satellites and in equipping earth stations offers the possibility of competition and mutual evaluation of the results achieved on an international scale. In this way a number of Czechoslovak instruments were built and used whose characteristics are rated very highly. In addition to a series of photometers measuring Roentgen radiation (RF) in the study of solar radiation and optical photometers (OF) for the study of radiation in the upper atmosphere, which are in use and are constantly being perfected beginning with the first type used in the Interkosmos 1 satellite (October 1969) to the photometers of the interplanetary probes Prognoz (1976, 1977), the micrometeorite detectors and analyzers of micrometeoric particles developed at TESLA-VUST play an important role in the equipment of satellites designed to study solar radiation and interplanetary matter. For all this flight deck equipment also corresponding control instruments were built which are used primarily in assembling and installing the equipment on board the satellites.

Another group of satellite instruments under development at TESLA-VUST comprises telemetric and measuring transmitters for geophysical research. They permit the monitoring of phenomena in the earth's magnetosphere and ionsphere in connection with other instruments on satellites. The transmitters are part of the telemetric systems which include also directional antennas, low static antenna amplifiers and receivers, i.e., those parts of the transmission system located in earth stations which are designed to receive signals from the satellites. The first partial testing of the telemetric system TC-1, which considerably enlarged the transmission capacity between the earth and the satellite and made possible direct transmission to stations in the CSSR and the USSR, was carried out toward the end of 1970 by intercepting signals from the Interkosmos 3 satellite. The complete system then went into operation when information was transmitted from the Interkosmos 5 satellite. At that time also the Soviet monitoring station was equipped with Czechoslovak antennas, amplifiers and receivers. The system was then in operation through a whole series of other satellites up to Interkosmos 14.

The operation of the new, so-called Uniform Telemetric System (JTMS) which was designed with the cooperation of work places in the USSR, the Hungarian Peoples Republic, the GDR, the Polish Peoples Republic and the CSSR was tested on the first automatic orbital station (AUOS) which went into orbit as Interkosmos 15. It is expected to be used not only in future AUOS, but also in the data collecting system from probes (SSPI) etc. The information can be transmitted both in analog and in digital form. For this system TESLA-VUST developed transmitters, modified antennas and antenna amplifiers from the first system and build deck signal simulators for the testing of receiving stations when they are not receiving signals from satellites. Other receiving stations established in Bulgaria and Cuba were equipped with these parts. Signal simulators are also in operation in stations in the GDR and the USSR. Receivers equipped for various systems and different frequency bands are also in preparation.

The 4-frequency beacon transmitters M4K were also developed and built together with control instruments and the respective receiver parts for ionospheric measurements by the Interkosmos 12 and 14 satellites.

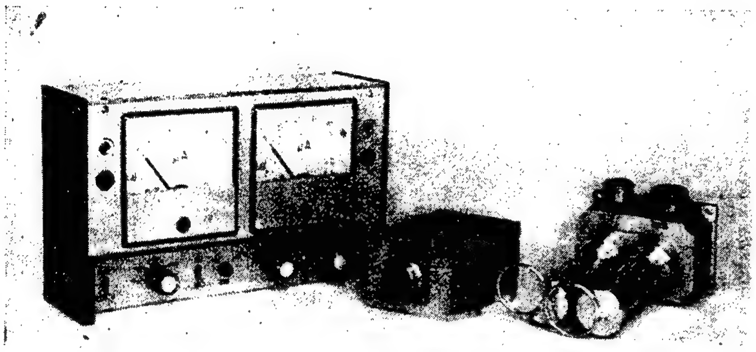
TESLA-VUST also developed an efficient spectral analyzer to process the data collected by satellites and transmitters in a broad analog spectrum. The attainable analytic velocity coincides with the recording velocity which in comparison with previous methods shortens manyfold the time required to evaluate the data.

To assess objectively the necessary reliability of the equipment and its parts the number of semiconductor elements used can be considered which, in the case of some current instruments being built, amounts to as many as 2000. This includes predominantly semiconductors of domestic manufacture from the national corporation TESLA Roznov and affiliated enterprises. Czechoslovak equipment contains only a small number of elements made in other socialist countries (interconnecting elements, control elements, some types of semiconductors whose production was assigned to another country by CEMA agreements etc.) Aside from reliability also power consumption is important in flight deck instruments.

Therefore, to reduce power consumption, hybrid circuits using considerably less energy were proposed as a replacement for some integrated circuits which draw more power. They were subsequently produced by the national enterprise TESLA Lanskroun and TESLA Hradec Kralove and are now part of an assortment of products which are also used in medical electronic equipment, in dosimeters etc. The above enterprises also supply additional parts, filters etc. and together with the national enterprise TESLA Jihlava and the other enterprises and plants of the electronics industry constitute the spare parts supply base for all the Czechoslovak satellite installations. Some of the types of radiation detectors used were developed at the Research Institute near Prague. Photomultipliers are supplied by the Research Institute for Vacuum Electrical Engineering, national enterprise TESLA. The ultimate characteristics of the equipment developed and the stability of its indicators is dependent on the long-term reliability of all parts and on their proper application. Tests performed so far demonstrated that properly used parts produced by us possess the required reliability.

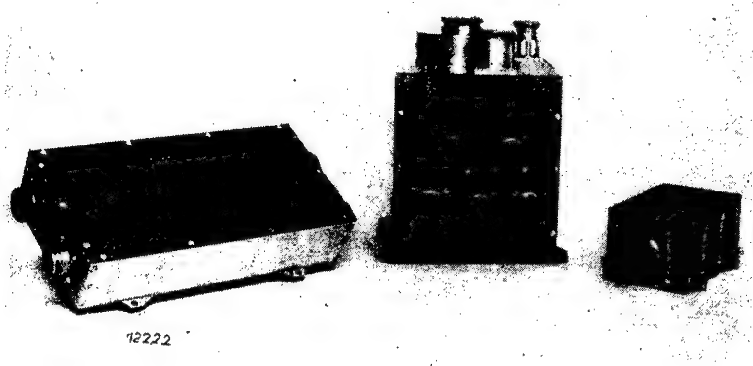
The research work performed within the framework of the Interkosmos program has consequences also for the other sectors of the TESLA-VUST work program and lays the ground for the application of the results achieved in a number of other projects. This brief description demonstrates that in many cases equipment is no longer designed to serve only a single purpose, on the contrary, many types can be used both in other fields of research directed by Interkosmos organization (space meteorology, medicine and biology, the search for natural resources by means of satellites etc.), as in other branches of the national economy which use various electronic devices to transmit measured data or receive signals from other transmitters etc.

Work successfully accomplished by scientific research opens up possibilities for using the satellite technology in other fields, in the exploration and mapping of areas in the search for natural resources, in environmental protection, in preparations to use space stations for technological operations etc.



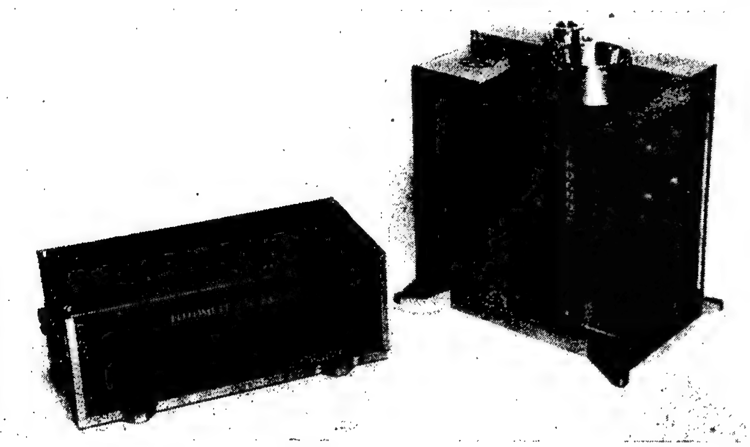
1

Optical photometer OF 71 for the study of the composition of the upper atmospheric layers of the earth. Used on Interkosmos 11 and 16 satellites.



2

Solar Roentgen radiation analyzer developed at TESLA-VUST for Interkosmos 4 and 7 satellites.



3

Roentgen radiation photometer RF-2-D for the interplanetary probes 5 and 6.

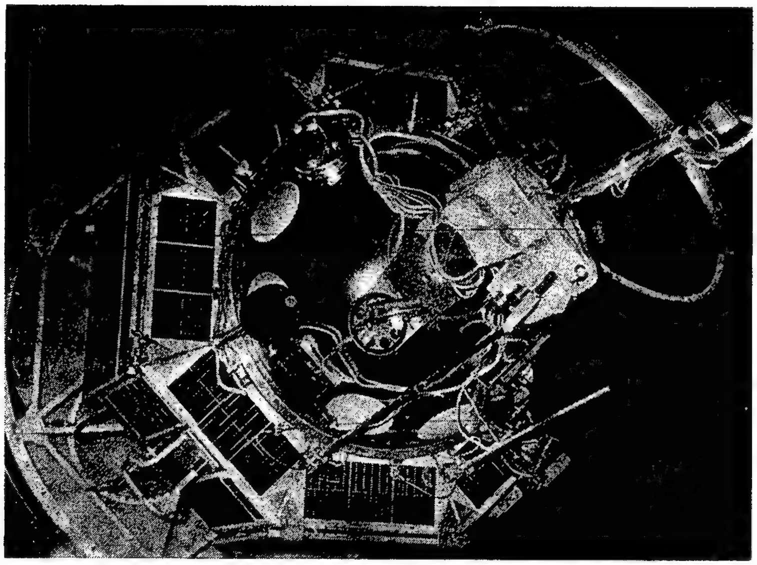
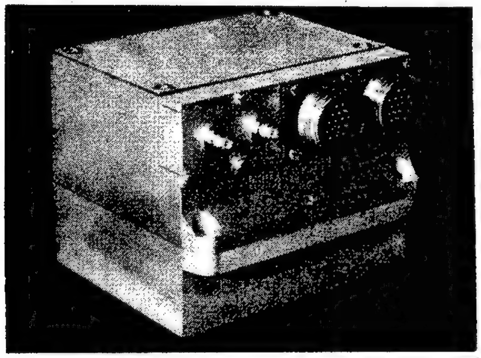
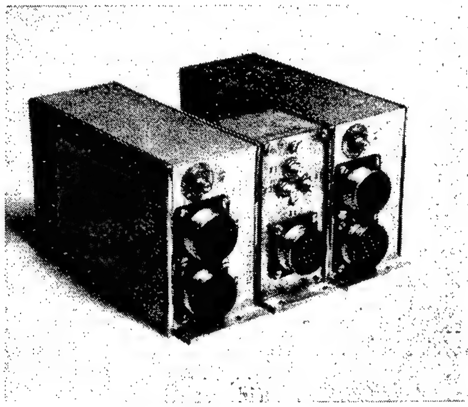


Figure 4. Satellite arrangement for ionospheric measurements with the last stage of the rocket.



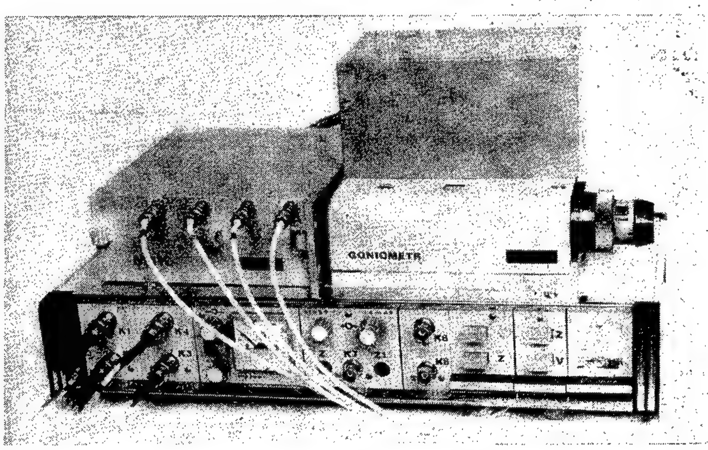
5

TC-1-C transmitter for the first broad-band telemetric system for Interkosmos program satellites (Interkosmos 5,9, 10,11,13, and 14 and the Soviet vertical rocket.)



6

TC-2-C transmitter and duplexer TC-2-CA designed for the so-called Uniform Telemetric System. Was tested for the first time on the Interkosmos 15 satellite.



7

Quadruple-frequency beacon transmitter M4K designed for ionospheric measurements on the Interkosmos 12 and 14 satellites together with control instruments.

Cooperation wit

Satellites and vertical rockets	
Kosmos	[illegible]
Interkosmos 1	1[illegible]
Interkosmos 2	[illegible]
Kosmos 321	[illegible]
KOSMOS 348	1[illegible]
Interkosmos 3	
Interkosmos 4	

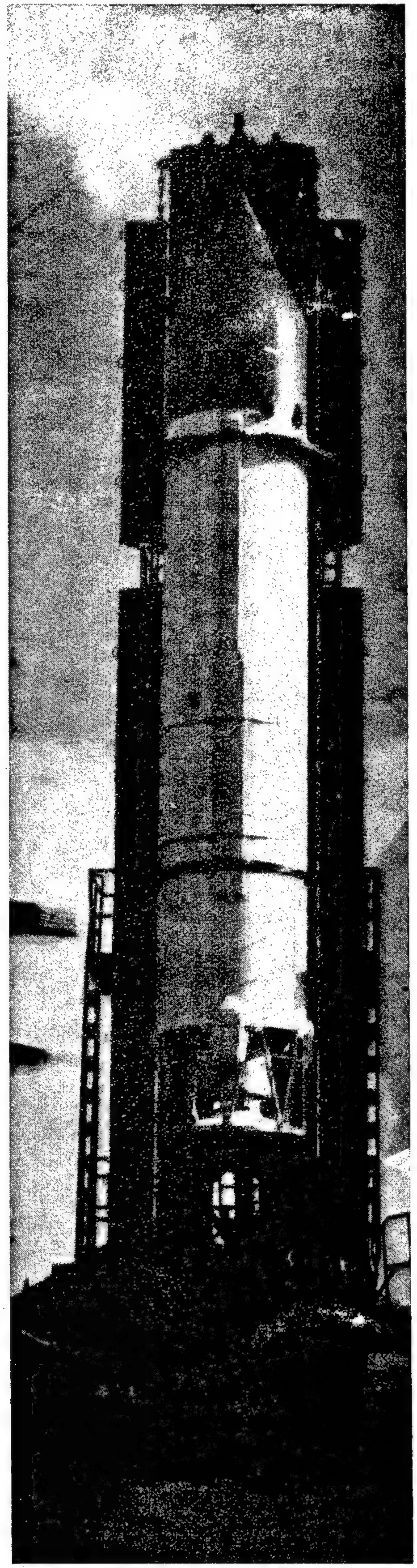
Satellites and vertical rockets	Start	Scientific tasks	Instruments supplied by	Participation in measuring, monitoring
Vertical 1	28 Nov 1970	Study of the Sun, the upper atmosphere of the Earth and of interplanetary matter	BPR, CSSR, HPR, GDR, PPR, USSR	CSSR, GDR, USSR
Kosmos 381	2 Dec 1970	Study of parameters of the ionosphere	GDR, USSR	BPR, CSSR, Cuba, GDR, PPR, RSR, USSR
Vertical 2	20 Aug 1971	Study of ultraviolet and Roentgen radiation of the Sun, parameters of the ionosphere and micrometeorites	BPR, CSSR, HPR, PPR, RSR, USSR	GDR, USSR
Interkosmos 5	2 Dec 1971	Study of the magnetosphere and nf electromagnetic waves of signals and of static	CSSR, USSR	BPR, CSSR, France, GDR, New Zealand, USSR
Interkosmos 6	7 Apr 1972	Study of high energy cosmic radiation, photorecording of meteorites	BPR, CSSR, PPR, RSR USSR	CSSR, PPR, USSR
Interkosmos 7	30 Jun 1972	Study of short-wave and Roentgen solar radiation and of its effects on the upper atmosphere of the Earth	CSSR, GDR, USSR	BPR, CSSR, HPR, GDR, PPR, RSR, USSR
Interkosmos 8	1 Dec 1972	Study of parameters of the Earth's upper atmosphere and ionosphere	BPR, CSSR, GDR, USSR	BPR, BSSR, Cuba, GDR, USSR

Satellites and vertical rockets	S
Interkosmos 9	19 A
Interkosmos 10	30 A
Interkosmos 11	17 Ma
Interkosmos 12	31 O
Interkosmos 13	27 Ma

Satellites and vertical rockets	Start	Scientific tasks	Instruments supplied by	Participation in measuring, monitoring
Vertikal 3 geophysical rocket	2 Sept 1975	Study of electro-magnetic phenomena in the ionosphere of the Earth	CSSR	USSR, GDR, BPR, CSSR
Interkosmos 14	11 Dec 1975	Comprehensive study of electro-magnetic phenomena in the magnetosphere and ionosphere of the Earth	BPR, CSSR, USSR	BPR, CSSR, USSR (GDR)
Interkosmos 15 (AUOS-Z-T)	19 Jun 1976	Technological object for functional testing of automatic orbital station AUOS and of the Uniform Tele-metric System	CSSR, HPR, GDR, PPR, USSR	CSSR, GDR, USSR, (PPR)
Interkosmos 16	26 Jul 1976	Study of Roentgen radiation of the Earth and the upper atmosphere of the Earth	CSSR, GDR, USSR, Sweden	CSSR, USSR, GDR, RSR
Vertikal 4 geophysical rocket	14 Oct 1976	Study of electro-magnetic phenomena in the Earth's ionosphere	CSSR	USSR, BPR, GDR, CSSR
Prognoz 5	25 Nov 1976	Study of solar radiation, particles of solar wind and cosmic radiation	USSR, CSSR	USSR, CSSR

Satellites vertical rockets	Start	Scientific tasks	Instruments supplied by	Participation in measuring, monitoring
Vertikal 5	30 Aug 1977	Study of micro-meteoric particles and composition of upper atmospheric layers	USSR, CSSR	USSR, CSSR
Prognoz 6	20 Sep 1977	Study of interplanetary space, solar activity and of its effect on the Earth's magnetosphere	USSR, CSSR, France	USSR, CSSR, France
Vertikal 6	1977	Geophysical study of the ionosphere	USSR, CSSR, HPR, BPR	USSR, CSSR, HPR, BPR
Interkosmos 17	24 Sep 1977	Study of particles and radiation of interplanetary matter	USSR, CSSR, HPR, RSR	USSR, CSSR, HPR, RSR

HPR=People's Republic of Hungary; BPR=Bulgarian Peoples Republic; PPR=Polish Peoples Republic; RSR=Rumanian Socialist Republi



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GEOPHYSICS, ASTRONOMY AND SPACE

TENTATIVE ASSESSMENT OF 1977 COSMOS PROGRAM PROVIDED

Paris L'AERONAUTIQUE ET L'ASTRONAUTIQUE in French No 3, 1978 pp 37-44

[Article by Didier Laurent]

[Text] In 1977 the Soviet Union effected 98 launchings and as a result placed 105 satellites in orbit.

Nineteen of these launchings were effected within the scope of specific space programs (Table 1): eight communications satellites (three Molnia 1, one Molnia 2, two Molnia 3, one Radouga, and one Ekran); four meteorological satellites (two Meteor 1 and two Meteor 2); three scientific satellites (Signe, Prognoz, and Intercosmos); three manned satellites (Soyuz); and one space station (Salyut).

The other 79 launchings, carried out within the scope of the diversified Cosmos program, put 86 satellites into operation; Table 2 presents a listing of them with the characteristics, as officially announced by the Soviets, of the initial orbits into which they were injected. The greater part (60) of the launchings were effected from the northern site at Plesetsk; the others from that at Tyuratam (18) and Kapustin Yar (1).

These 86 Cosmos satellites are categorized as follows:

--78 military applications satellites;

--1 civil applications satellite;

--2 satellites serving for flight testing;

--2 satellites related to the manned flight program;

--3 scientific satellites.

Table 1. Launchings Effected in 1977 by the Soviets Within the Scope of Specific Programs

Designation	Launching: Date	Launching: Place	Launching: Launcher	Initial orbit: Apogee (km)	Initial orbit: Perigee (km)	Initial orbit: Inclination (degrees)	Initial orbit: Period (minutes)	Purpose
Meteor 2-2	7 Jan	Plesetsk	A-1	932.1	829.9	81.3	103	Meteorology
Soyuz 24	7 Feb	Tyuratam	A-2	253	238	51.6	89.6	Manned flight
Molnia 2-17	11 Feb	Plesetsk	A-2-e	40,757	593	62.5	735	Communications
Molnia 1-36	24 Mar	Plesetsk	A-2-e	40,816	484	62.6	736	Communications
Meteor 1-27	5 Apr	Plesetsk	A-1	909	869	81.2	102.5	Meteorology
Molnia 3-7	28 Apr	Plesetsk	A-2-e	40,817	467	62.8	736	Communications
Signe 3	17 Jun	Kapustin Yar	C-1	519	459	50.67	94.33	Scientific
Molnia 1-37	24 Jun	Plesetsk	A-2-3	39,016	480	62.9	720	Communications
Meteor 1-28	29 Jun	Tyuratam	A-1	685	602	98	97.5	Meteorology
Radouga 3	24 Jul	Tyuratam	D-1-e	36,000	36,000	0.4	1,477	Communications
Molnia 1-38	30 Aug	Plesetsk	A-2-e	40,000	480	62.8	736	Communications
Ekran 2	20 Sep	Tyuratam	D-1-e	35,560	35,560	0.4	1,425	Communications
Prognoz 6	22 Sep	Tyuratam	A-2-e	200,000	489	65	5,688	Scientific
Intercosmos 17	24 Sep	Plesetsk	C-1	519	468	83	94.4	Scientific
Salyut 6	29 Sep	Tyuratam	D-1	275	219	51.6	89.1	Space station
Soyuz 25	9 Oct	Tyuratam	A-2	240	194	51.6	88.78	Manned flight
Molnia 3-8	28 Oct	Plesetsk	A-2-e	40,764	478	62.8	735	Communications
Soyuz 26	10 Dec	Tyuratam	A-2	329	297	51.6	90.2	Manned flight
Meteor 2-3	14 Dec	Plesetsk	A-1	906	872	81.2	102.5	Meteorology

Table 2. Cosmos Satellite Launchings Effected by the Soviets in 1977

	Launching			Officially announced orbit				
No	Date	Place	Launcher	Apogee (km)	Perigee (km)	Inclination (degrees)	Period (minutes)	Purpose
888	6 Jan	Tyuratam	A-2	346	178	65.0	89.5	Photographic reconnaissance
889	20 Jan	Tyuratam	A-2	353	210	71.4	89.8	Photographic reconnaissance
890	20 Jan	Plesetsk	C-1	1,032	1,000	83.0	105	Navigation
891	2 Feb	Plesetsk	C-1	518	466	65.8	94.4	Target?
892	9 Feb	Plesetsk	A-2	454	170	72.9	90.4	Photographic reconnaissance
893	15 Feb	Plesetsk	C-1	1,703	341	74.0	105.25	Scientific
894	21 Feb	Plesetsk	C-1	1,026	988	83.0	105.1	Navigation
895	27 Feb	Plesetsk	A-1	648	613	81.2	97.2	Electronic surveillance
896	3 Mar	Plesetsk	A-2	216	194	72.9	88.5	Photographic reconnaissance
897	10 Mar	Plesetsk	A-2	371	182	72.9	89.7	Photographic reconnaissance
898	17 Mar	Plesetsk	A-2	258	222	81.4	89	Photographic reconnaissance
899	24 Mar	Plesetsk	C-1	552	505	74.1	95.2	Electronic surveillance
900	30 Mar	Plesetsk	C-1	523	460	83.0	94.4	Scientific
901	5 Apr	Plesetsk	B-1	845	279	71.0	95.5	Flight testing
902	7 Apr	Plesetsk	A-2	307	179	81.4	89.0	Photographic reconnaissance
903	11 Apr	Plesetsk	A-2-e	40,170	630	62.8	726	Early warning
904	20 Apr	Tyuratam	A-2	350	210	71.4	89.8	Photographic reconnaissance
905	26 Apr	Plesetsk	A-2	366	179	67.1	89.7	Photographic reconnaissance
906	27 Apr	Kapustin Yar	C-1	523	466	50.7	94.3	Scientific
907	5 May	Plesetsk	A-2	388	187	62.8	89.9	Photographic reconnaissance
908	17 May	Tyuratam	A-2	307	180	51.8	89.1	Photographic reconnaissance
909	19 May	Plesetsk	C-1	2,112	991	65.9	117	Target
910	23 May	Tyuratam	F-1-m	506	149	65.1	91	Interception
911	25 May	Plesetsk	C-1	1,018	984	82.9	104.9	Navigation
912	26 May	Plesetsk	A-2	257	219	81.4	89	Detection of earth resources
913	31 May	Plesetsk	C-1	523	475	74.0	94.5	Electronic surveillance
914	31 May	Tyuratam	A-2	327	210	65.0	89.6	Photographic reconnaissance
915	8 Jun	Plesetsk	A-2	306	182	62.8	89.1	Photographic reconnaissance
916	10 Jun	Plesetsk	A-2	307	250	62.8	89.9	Photographic reconnaissance

Table 2 (Continued)

No	Launching: Date	Launching: Place	Launching: Launcher	Officially announced orbit: Apogee (km)	Perigee (km)	Inclination (degrees)	Period (minutes)	Purpose
917	16 Jun	Plesetsk	A-2-e	40,150	625	62.9	725	Early warning
918	17 Jun	Tyuratam	F-1-m	265	131	65.1	88.4	Interception
919	18 Jun	Plesetsk	B-1	847	278	71	95.6	Flight testing
920	22 Jun	Tyuratam	A-2	364	180	65.0	89.7	Photographic reconnaissance
921	24 Jun	Plesetsk	C-1	711	644	76.0	98.0	?
922	30 Jun	Plesetsk	A-2	323	212	62.8	89.5	Photographic reconnaissance
923	1 Jul	Plesetsk	C-1	842	804	74.0	101.4	Telecommunications
924	5 Jul	Plesetsk	C-1	560	514	74.0	95.3	Electronic surveillance
925	7 Jul	Plesetsk	A-1	645	622	81.2	97.2	Electronic surveillance
926	9 Jul	Plesetsk	C-1	1,025	997	82.9	105.1	Navigation
927	12 Jul	Plesetsk	A-2	403	178	72.9	90.0	Photographic reconnaissance
928	13 Jul	Plesetsk	C-1	1,022	977	83.0	104.8	Navigation
929	17 Jul	Tyuratam	D-1	298	221	51.6	89.4	Flight testing of manned vehicle
930	19 Jul	Plesetsk	C-1	528	482	74.0	94.6	Electronic surveillance
931	20 Jul	Plesetsk	A-2-e	40,180	600	62.8	726	Early warning
932	20 Jul	Tyuratam	A-2	342	180	65.0	89.5	Photographic reconnaissance
933	22 Jul	Plesetsk	C-1	418	385	65.8	92.5	Target?
934	27 Jul	Plesetsk	A-2	264	238	62.8	89.4	Photographic reconnaissance
935	29 Jul	Plesetsk	A-2	276	225	81.3	89.3	Photographic reconnaissance
936	3 Aug	Plesetsk	A-2	419	224	62.8	90.7	Biological research
937	24 Aug	Tyuratam	F-1-m	457	438	65.0	93.13	Ocean surveillance
938	24 Aug	Plesetsk	A-2	365	189	62.8	89.7	Photographic reconnaissance
939-946	24 Aug	Plesetsk	C-1	1,518	1,448	74.0	115.2	Telecommunications
947	27 Aug	Plesetsk	A-2	346	211	72.8	89.7	Photographic reconnaissance
948	2 Sep	Plesetsk	A-2	265	217	81.4	89.0	Photographic reconnaissance
949	6 Sep	Plesetsk	A-2	348	184	62.8	89.5	Photographic reconnaissance
950	13 Sep	Plesetsk	A-2	305	213	62.8	89.4	Photographic reconnaissance
951	13 Sep	Plesetsk	C-1	1,029	989	83.0	105.0	Navigation

Table 2 (Continued)

No	Launching: Date	Launching: Place	Launching: Launcher	Officially announced orbit: Apogee (km)	Officially announced orbit: Perigee (km)	Officially announced orbit: Inclination (degrees)	Officially announced orbit: Period (minutes)	Purpose
952	16 Sep	Tyuratam	F-1-m	278	258	65.0	89.7	Ocean surveillance
953	16 Sep	Plesetsk	A-2	354	188	62.8	89.6	Photographic reconnaissance
954	18 Sep	Tyuratam	F-1-m	277	259	65.0	89.6	Ocean surveillance
955	20 Sep	Plesetsk	A-1	664	631	81.2	97.5	Electronic surveillance
956	24 Sep	Plesetsk	C-1	865	358	75.8	96.9	?
957	30 Sep	Tyuratam	A-2	381	181	65.0	89.8	Photographic reconnaissance
958	11 Oct	Plesetsk	A-2	369	265	62.8	90.5	Photographic reconnaissance
959	21 Oct	Plesetsk	C-1	891	153	66.0	88.5	Target
960	26 Oct	Plesetsk	C-1	549	505	74.0	95.1	Electronic surveillance
961	26 Oct	Tyuratam	F-1-m	302	125	66.0	88.5	Interception
962	28 Oct	Plesetsk	C-1	1,022	983	83.0	104.9	Navigation
963	24 Nov	Plesetsk	C-1	1,220	1,190	82.9	109.3	Geodesy
964	4 Dec	Plesetsk	A-2	391	180	72.9	89.9	Photographic reconnaissance
965	8 Dec	Plesetsk	C-1	520	469	74.0	94.4	Electronic surveillance
966	12 Dec	Tyuratam	A-2	316	210	65.0	89.5	Photographic reconnaissance
967	13 Dec	Plesetsk	C-1	1,013	973	66	105	Target
968	16 Dec	Plesetsk	C-1	812	783	74.0	101	Telecommunications
969	20 Dec	Plesetsk	A-2	340	188	62.8	89.5	Photographic reconnaissance
970	21 Dec	Tyuratam	F-1-m	1,160	954	65.8	106.0	Interception
971	23 Dec	Plesetsk	C-1	1,021	993	83.0	105	Navigation
972	27 Dec	Plesetsk	C-1	1,189	772	75.8	104	?
973	27 Dec	Tyuratam	A-2	348	210	71.4	89.8	Photographic reconnaissance

Military Applications

The principal purposes of the 78 military applications satellites were:

--photographic reconnaissance (32);
--telecommunications (10);
--interception (9);
--electronic surveillance (9);
--navigation (8);
--ocean surveillance (3);
--early warning (3);
--purpose unknown (3); and
--geodesy (1).

Photographic Reconnaissance

The 32 photographic reconnaissance satellites (Table 3) are classified as follows according to their launch sites and inclination angle of their orbits:

--one (Cosmos 908) launched from Tyuratam and injected into an orbit inclined at 51.8 degrees;

--eleven (Cosmos 907, 915, 916, 922, 934, 938, 949, 950, 953, 958 and 969) launched from Plesetsk and injected into orbits inclined at 62.8 degrees;

--six (Cosmos 888, 914, 920, 932, 957 and 966) launched from Tyuratam and injected into orbits inclined at 65 degrees;

--one (Cosmos 905) launched from Plesetsk and injected into an orbit inclined at 67.1 degrees;

--three (Cosmos 889, 904 and 973) launched from Tyuratam and injected into orbits inclined at 71.4 degrees;

--six (Cosmos 892, 896, 897, 927, 947 and 964) launched from Plesetsk and injected into orbits inclined at 72.9 degrees;

--four (Cosmos 898, 902, 935 and 948) launched from Plesetsk and injected into orbits inclined at 81.3-81.4 degrees.

Launched by type A-2 boosters, these satellites orbit for a number of days before being brought back to earth by action of a retro-rocket which causes them to reenter the atmosphere. Some of these satellites perform maneuvers, that is, modify the geometric characteristics of their orbits without, however, appreciably changing the inclination, and before reentry, generally the day before, eject a module which is believed to consist of the motor with which they are equipped in order to effect such maneuvers.

Table 3. Cosmos Photographic Reconnaissance Satellites Launched by the Soviets in 1977

No	Launching date	Inclination (degrees)	Life (days)	Remarks*
888	6 Jan	65.0	13	T,H,M
889	20 Jan	71.4	12	T,B
892	9 Feb	72.9	13	P,H,M
896	3 Mar	72.9	13	P,H,M
897	10 Mar	72.9	13	P,H,M
898	17 Mar	81.4	13	P,B,I
902	7 Apr	81.4	13	P,H,M
904	20 Apr	71.4	14	T,B
905	26 Apr	67.1	30	P,H,M
907	5 May	62.8	11	P,H,M
908	17 May	51.8	14	T,H
914	31 May	65.0	13	T,B
915	8 Jun	62.8	13	P,H,M
916	10 Jun	62.8	11	P,B
920	22 Jun	65.0	13	T,H,M
922	30 Jun	62.8	13	P,B
927	12 Jul	72.9	13	P,H,M
932	20 Jul	65.0	13	T,H,M
934	27 Jul	62.8	13	P,H,M
935	29 Jul	81.3	13	P,B
938	24 Aug	62.8	13	P,H
947	27 Aug	72.8	13	P,B
948	2 Sep	81.4	13	P,B,I
949	8 Sep	62.8	30	P,H,M
950	13 Sep	62.8	14	P,B
953	16 Sep	62.8	13	P,H,M
957	30 Sep	65.0	13	T,H,M
958	11 Oct	62.8	13	P,B,M
964	4 Dec	72.9	13	P,H,M
966	12 Dec	65.0	12	T,B
969	20 Dec	62.8	14	P,H
973	27 Dec	71.4	13	T,B

* B: equipped with low resolution cameras
H: equipped with high resolution cameras
I: with instrument module
M: with maneuvering motor
P: launched from Plesetsk
T: launched from Tyuratam

Other satellites, which do not effect maneuvers, also eject before reentry, generally the day before, a module which is believed to consist of instruments. It therefore seems that there are three models of photographic reconnaissance satellites.

In 1977, at the Le Bourget International Satellite, the USSR pavilion displayed a replica of Cosmos 782, a recoverable biological research satellite. Exhibition of this satellite, whose characteristics are apparently closely similar to those of the photographic reconnaissance satellites, has made it possible to form a more precise idea of the configuration of these three models. It appears that there is a basic model to which can be added a supplementary cylindrical module containing either a maneuvering motor or an equipment compartment.

The basic model has a configuration similar to that of the Vostok manned satellites. Consisting of a recoverable spherical module, a cylindrical service module, and a conical module containing the retro-rocket, it is 5 meters long, with maximum diameter of 2.2 meters, and is estimated to weigh 5,500 kilograms. The supplementary module, attached to a support on the front of the spherical module, is 2 meters in diameter and 0.5 meter long. Including the support its overall length is about 1 meter and its mass close to 500 kilograms and as a result the satellites which include this module measure 6 meters in length and have a mass of 6,000 kilograms.

A far as photographic reconnaissance satellites are concerned, the principal innovation that can be detected resides in the increased length of time they are in orbit. The Soviets in fact increased the life, which was a maximum of 14 days, at first to 20 days with Cosmos 876 launched in 1976, and then to 30 days with Cosmos 905 and 949. The fact that the first two of these satellites were placed in orbits inclined at about 67 degrees and the last into a more traditional orbit inclined at 62.8 degrees seems to indicate that the experimentation phase has ended, a phase which probably began with the launching of Cosmos 758 which, placed into an orbit also inclined at 67 degrees, exploded the same day it was launched when its maneuvering motor was actuated.

Of the 32 photographic reconnaissance satellites launched in 1977, 19 were probably equipped with high resolution cameras.

Telecommunications

The 10 military telecommunications satellites, launched from Plesetsk, are of two classes:

--eight satellites (Cosmos 939-946, inclusive), launched in series by C-1 type boosters and initially injected into almost circular orbits at about 1,500 kilometers altitude, inclined at 74 degrees, and spaced with angular separations of from 20 to 60 degrees;

--two satellites (Cosmos 923 and 968) also launched by C-1 type boosters, placed into almost circular orbits at 800 to 850 kilometers altitude, also inclined at 74 degrees.

The satellites of the first class are spheroids of 40 kilograms, approximately 1 meter long and with maximum diameter of 0.8 meter. They are part of a network of telecommunications relays which enable units of the Soviet naval forces, including submarines, to stay in contact with each other and the naval command center.

The satellites of the second class are cylinders of 750 kilograms, fitted with panels, and measuring 2 meters in length and 1 meter in diameter. They are used to record and retransmit military and secret communications.

Interception

It appears that nine satellites were launched within the scope of the program to perfect interception satellites:

--three target satellites (Cosmos 909, 959 and 967);

--four interceptor satellites (Cosmos 910, 918, 961 and 970);

--two satellites (Cosmos 891 and 933) whose role cannot be clearly explained.

Table 4. Cosmos Satellites Involved in Interception Tests Effected by the Soviets in 1977

No	Type	Apogee (km)	Perigee (km)	Inclination (degrees)	Period (minutes)	Remarks
909	Target	2,112	991	65.9	117	Officially announced orbit
910	Interceptor	1,774	300	65.86	99.56	Observed orbit (a)
		506	149	65.1	91	Officially announced orbit (b)
918	Interceptor	265	131	65.1	88.4	Officially announced orbit (c)
959	Target	891	153	66.0	94.8	Officially announced orbit
961	Interceptor	302	125	66.0	88.5	Officially announced orbit (d)
		1,421	269	66.4	101.8	Observed orbit (e)
967	Target	1,013	973	66.0	105	Officially announced orbit
970	Interceptor	861	144	65.16	94.67	Observed orbit (f)
		1,160	954	65.8	106	Officially announced orbit (g)

In the course of the year four attempts at interception (Table 4), of which only two can be considered successful, were effected:

--Cosmos 910 was placed into an eccentric orbit (a), not officially announced by the Soviets, which was not allowed to get nearer than several hundred kilometers to Cosmos 909 and was then transferred to an orbit with low perigee (b) and plunged into the atmosphere after completing less than a single orbit;

--Cosmos 918 was probably placed into an eccentric orbit of unknown parameters not officially announced by the Soviets who allowed it, after having completed less than a single orbit, to pass close to Cosmos 909, and it was then transferred to an orbit of very low perigee, and plunged into the atmosphere about 1 day after it was launched;

--Cosmos 961 was injected into an orbit of very low perigee (d), then was transferred into a more eccentric orbit (e), not officially announced by the Soviets, before its reentry was actuated about 18 hours after it was launched. After having completed at least one orbit Cosmos 961 passed in proximity to Cosmos 959 which right now is at 169 kilometers altitude northwest of Moscow;

--Cosmos 970 was injected into an eccentric orbit of low perigee (f), not officially announced by the Soviets, then was transferred into an orbit (g) with parameters closely similar to those of Cosmos 967 before being destroyed in flight by an explosion. The approach was not close enough for the interception to be considered successful.

Launched from Plesetsk, the target satellites are cylindrical bodies, 4 meters long and 2 meters in diameter, placed into orbits inclined at 66 degrees by a C-1 type booster. It should be noted that the orbit of the Cosmos 959 has geometric characteristics closely similar to those of the American Big Bird photographic reconnaissance satellites.

Launched from Tyuratam, the interceptor satellites are apparently similar to the target satellites (same shape and same dimensions) but are injected into orbit by an F-1-m booster with a maneuvering motor.

As for the two satellites Cosmos 891 and 933, launched from Plesetsk with a C-1 type booster and also injected into orbits inclined at 66 degrees, they have the characteristics of target satellites but have not given rise to any attempt at interception.

Despite the failures experienced by the Soviets during their experiments the U.S. secretary of defense on 4 October 1977 was of the opinion that Soviet interception satellites could be considered operational, at least against certain satellites orbiting at low altitudes.

Electronic Surveillance

The nine electronic surveillance satellites, launched from Plesetsk, are of two classes:

--six satellites (Cosmos 899, 913, 924, 930, 960 and 965) injected into almost circular orbits at 500-550 kilometers altitude, inclined at 74 degrees;

--three satellites (Cosmos 895, 925 and 955) injected into almost circular orbits at 600-650 kilometers altitude, inclined at about 81.2 degrees.

Their function is to receive electromagnetic communications and signals, record these data, and retransmit them while flying over territory of the Soviet Union.

The satellites of the first class are launched by C-1 type boosters, have a mass on the order of 900 kilograms, are in the form of cylinders 2 meters long and 1 meter in diameter, and provided with fins. They are specially intended to capture a large volume of communications most of which consist of messages heard only once.

The satellites of the second class are launched by A-1 type boosters, have a mass on the order of 2,500 kilograms, are in the form of cylinders 5 meters long and 1.5 meters in diameter, and provided with two panels. They are particularly intended for surveillance of a wide range of frequencies and within this range to listen to certain specific sources of electromagnetic signals, radars for example.

Navigation

The eight navigation satellites (Cosmos 890, 894, 911, 926, 928, 951, 962 and 971), launched from Plesetsk by C-1 type boosters, were placed into almost circular orbits at about 1,000 kilometers altitude, inclined at 83 degrees.

These cylindrical satellites of 700 kilograms, measuring approximately 1.3 meters in length and 1.9 meters in diameter, are designed to transmit signals which will enable surface ships and submarines which receive them and know the position of the transmitting satellite to determine their own positions.

Ocean Surveillance

Launched from Tyuratam by F-1-m boosters and injected into orbits inclined at 65 degrees, the three ocean surveillance satellites fall into two classes:

--two satellites (Cosmos 952 and 954) initially injected into almost circular orbits at low altitudes (260-280 kilometers) and, usually, next transferred into almost circular orbits at about 1,000 kilometers altitude;

--one satellite (Cosmos 937) initially injected into an almost circular orbit at higher altitude (440-460 kilometers) where it remained.

These satellites, provided with a radar operating by means of a radioactive energy source are designed to detect, whatever the meteorological conditions may be, the movements of ships at sea even if they maintain radio silence.

They are cylindrical-conical satellites, identical on the exterior, 6 meters long and with maximum diameter of 2 meters. Those of the first class remain attached to the last stage of the booster rocket up to the time of their injection into orbit at 1,000 kilometers altitude.

In contrast with all other ocean surveillance satellites launched up to now, Cosmos 954 reentered the atmosphere over northwest Canada on 24 January 1978. This reentry, obviously inopportune, resulted from faulty execution of the maneuver intended to transfer the satellite into a higher orbit. Debris recovered on the ground confirmed the belief that ocean surveillance satellites are provided with a nuclear reactor for producing the electrical energy necessary for the functioning of the on-board radar. It appears that this reactor has a mass on the order of 450 kilograms, using about 50 kilograms of uranium-235, with electrical power output of 1 kilowatt.

As for Cosmos 952, it was transferred into a higher orbit on 8 October 1977, that is, much more rapidly than its predecessors.

Early Warning

Launched from Plesetsk type A-2-e boosters, the three early warning satellites (Cosmos 903, 917 and 931) were placed into elliptical orbits inclined at 62.8 degrees, having apogee and perigee close to 40,000 kilometers and 600 kilometers respectively.

Their function is to detect the launchings of missiles and space vehicles and to provide, to receiving stations located on territory of the Soviet Union, data on the trajectories followed and the signatures accompanying such launchings, that is, signals received during that phase.

They are cylindrical-conical satellites of about 1,250 kilograms, provided with six panels and with antennas, measuring 4.2 meters in length and 1.6 meters at maximum diameter, and having many similarities to the Molnia 2 civil telecommunications satellites.

Cosmos 921, 956 and 972

Launched from Plesetsk with C-1 type boosters, these three satellites were placed into orbits inclined at about 76 degrees, an inclination never before used by the Soviets. Aside from inclination the orbits are hardly analogous (Table 5).

Table 5. Geometric Characteristics of Orbits of Three Cosmos Satellites of Unknown Purpose

No	Apogee (km)	Perigee (km)	Inclination (degrees)	Period (minutes)
921	711	644	76.0	98.0
956	865	358	75.8	96.9
972	1,189	772	75.8	104

For the present, there is known neither the configuration of these satellites nor their mass, which, however, probably does not exceed 900 kilograms, considering the capability of the booster used. Much thought can be wasted in conjecture about the mission or missions that may be intended for these satellites but the silence maintained by the Soviets leads to the belief that they are probably military applications satellites.

Geodesy

Launched from Plesetsk by a type C-1 booster, Cosmos 963 was placed into an almost circular orbit at about 1,200 kilometers altitude inclined at about 83 degrees.

Like that of its two predecessors (Cosmos 480 and 770, launched in 1972 and 1975 respectively) its function is to define the geoid with sufficient precision that strategic ballistic missiles can hit their targets.

Flight Testing

Launched from Plesetsk by type B-1 boosters, Cosmos 901 and 919 were placed into orbits inclined at 71 degrees, having an apogee close to 850 kilometers and a perigee near 280 kilometers.

These two ellipsoidal satellites of 400 kilograms, 1.8 meters long with 1.2 meters maximum diameter seem to have been used as flying "test benches" for experimentation with various components, devices, and systems intended to be installed aboard military satellites or possibly for experimentation with new configurations for military satellites.

Civil Applications

Launched from Plesetsk by a type A-2 booster, Cosmos 912 was placed into a low orbit inclined at 81.4 degrees and orbited for 13 days before being recovered on earth. The day before its reentry it ejected an equipment module.

This satellite, 6 meters long with maximum diameter of 2.2 meters, and mass of 6,000 kilograms, appears to be identical with the photographic reconnaissance satellites and the Soviets announced officially that it was an earth resources detection satellite.

Satellites Related to Manned Flight Program

Within the scope of its program for exploration of the space near the earth by means of manned satellites the Soviet Union has launched two unmanned satellites:

--Cosmos 929, launched from Tyuratam by a type D-1 booster, and placed into a low orbit inclined at 51.6 degrees;

--Cosmos 936, launched from Plesetsk by a type A-2 booster, and placed into a low orbit inclined at 62.8 degrees.

Cosmos 929, a cylindrical satellite 15 meters long, 3 meters in diameter, and with mass of 16,000 kilograms, was initially placed into an orbit similar to that of the Soyuz (the Soyuz 24 in particular), and was maneuvered seven times, its apogee varying by more than 80 kilometers, before its reentry above the Pacific Ocean was effected on 2 February 1978.

The telemetry transmitted by Cosmos 929 comprised two distinct signals and it is believed that the satellite might be constituted by the union of two vehicles, which suggests possible hook-ups with the double launching of Cosmos 881 and 882 at the end of 1976.

Cosmos 929, with dimensions comparable with those of the Salyut, could be a new model of space station or a support vehicle for space stations.

Belonging to the same family as Cosmos 782 displayed at the Le Bourget Salon, Cosmos 936, recovered on earth after 19 days in orbit, was a biological research satellite also provided with equipment for study of radiation physics intended to effectuate experiments designed by the USSR, Czechoslovakia, France and the United States.

Scientific Satellites

Last, within the scope of the Cosmos program the Soviet Union launched three scientific satellites, Cosmos 893, 900 and 906.

Cosmos 893, launched from Plesetsk by a type C-1 booster, was placed into an elliptical orbit (apogee 1,703 kilometers; perigee 341 kilometers) inclined at 74 degrees, practically the same as some Intercosmos satellites, Intercosmos 14 in particular. The body injected into orbit is a cylinder 9.2 meters long and 2.4 meters in diameter. It is presumably a 550-kilogram satellite of ellipsoidal shape (1.8 meters long with maximum diameter of 1.5 meters) remaining coupled to the last stage of its booster rocket. It is probably intended for study of the electromagnetic variations and structures of the ionosphere.

Cosmos 900, launched from Plesetsk by a type C-1 booster, was placed into an almost circular orbit at about 500 kilometers altitude, inclined at 83 degrees. This 900-kilogram satellite, carrying apparatus provided by Czechoslovakia and East Germany, was launched within the scope of an international program of research into the magnetosphere, and especially for study of the aurora borealis.

Cosmos 906, launched from Kapustin Yar by a type C-1 booster, was placed into a nearly circular orbit at about 500 kilometers altitude, inclined at 50.7 degrees. As with Cosmos 893, the body placed into orbit is a cylinder of about 2,750 kilograms, 9.2 meters long and 2.4 meters in diameter, probably consisting of a small satellite, properly speaking, remaining coupled to the last stage of its booster rocket. Although little detail has been provided by the Soviets, the choice of the Kapustin Yar site is an indication of the scientific nature of this satellite's mission.

In 1977 activity within the scope of the Cosmos program was slightly less than in 1976 (which was the record year), not in the number of launchings effected but in the number of satellites placed into orbit. They remain military for the most part.

As can be seen from Table 6 which recapitulates the courses of the various programs during the last 5 years, programs previously started were continued. However, it is appropriate to observe the increased time in orbit of certain photographic reconnaissance satellites (30 days), the smaller number of telecommunications satellites for the navy, the effort made in the domain of early warning satellites, the appearance of a new type of satellite whose purpose has not been established, the resumption of scientific experimentation, and the debut of earth resources detection satellites.

Table 6. Course of the Cosmos Program During the Last 5 Years

Year	1973	1974	1975	1976	1977
Number of launchings	64	60	84	79	79
Number of satellites launched	85	74	85	101	86
Military Applications	62	52	72	86	78
Photographic reconnaissance	35	28	34	34	32
inclined 51.6-51.8 degrees	2	1	0	0	1
inclined 62.8 degrees	0	10	13	9	11
inclined 65 degrees	5	7	8	9	6
inclined 65.4 degrees	12	0	0	0	0
inclined 67.2 degrees	0	0	1	2	1
inclined 70 degrees	1	0	0	0	0
inclined 71.4 degrees	0	1	4	3	3
inclined 72.9 degrees	13	5	3	5	6
inclined 81.3 degrees	2	4	5	6	4
Telecommunications	25	17	26	27	10
at about 1,500 km, inclined 74 degrees	24	16	24	24	8
at 800-850 km, inclined 74 degrees	1	1	2	3	2
Interception	0	0	1	9	9
target	0	0	0	3	3
interceptor	0	0	0	4	4
purpose uncertain	0	0	1	2	2
Navigation	3	4	4	8	8
Electronic surveillance	5	5	5	9	9
at 500-550 km, inclined 74 degrees	4	4	3	7	6
at 600-650 km, inclined 81.2 degrees	1	1	2	2	3
Ocean surveillance	1	3	4	4	3
at 260-280 km, inclined at 65 degrees	1	2	3	2	2
at 440-460 km, inclined at 65 degrees	0	1	1	2	1
Early warning	1	1	1	1	3
Navigation/geodesy	1	2	2	0	1
Purpose unknown	0	0	0	0	3
Flight Testing	9	9	8	5	2
elliptical orbit inclined at 71 degrees	8	6	4	4	2
elliptical orbit inclined at 74 degrees	0	1	0	1	0
elliptical orbit inclined at 82 degrees	1	0	1	0	0
elliptical orbit inclined at 83 degrees	0	1	0	1	0
Civil Applications	0	1	1	0	1
telecommunications	0	1	1	0	0
detection of earth resources	0	0	0	0	1
Scientific Satellites	1	0	0	0	3
Satellites Related to Manned Flight Program	4	5	2	1	2
Soyuz type	2	4	1	1	0
Salyut type	1	0	0	0	1
Medical-biological research	1	1	1	0	1
Failures	0	0	0	2	0

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BIOGRAPHICAL DATA ON PETR PETROVICH LAZARE

Moscow USPEKHI FIZICHESKIKH NAUK in Russian Vol 125 No 1, May 78 signed to press 18 Apr 78 pp 11-18

[Article by B. V. Deryagin]

[Text] Petr Petrovich Lazarev was born on 14 April 1878 in Moscow into the family of a surveyor.

After graduation from Moscow Secondary School No 4 in 1896 P. P. Lazarev matriculated in the Medical Faculty of Moscow University. Although he displayed great interest in physics, chemistry and mathematics and was less interested in practical medicine, that step was called for because graduation from the Faculty of Physics and Mathematics did not offer clear prospects for scientific work in the future. Upon graduation (with homors) from the Medical Faculty P. P. Lazarev matriculated in the autumn of 1902 in the Mathematical Sciences Department of the Faculty of Physica snd Mathematics of Moscow University. In 1903 he passed all the state examinations without having attended lectures. In the same year, having passed the doctoral examinations in medicine, he was selected to be an assistant in the Clinic of Diseases of the Ear, Nose and Throat of Moscow University, where he conducted his first investigations of physiological acoustics. However, acquaintance with P. N. Lebedev and particpation in the oral examinations conducted by him led P. P. Lazarev to transfer his own investigations to P. N. Lebedev's physics laboratory at the university, to which he was transferred as an assistant professor. There he completed and in 1911 defended his master's dissertation on the subject "On the temperature jump in the presence of thermal conductivity on the boundary of a solid body and a gas." This was the first experimental investigation of the effect, which was examined on the basis of Smolukhovskiy's kinetic theory of gases.

In 1912 P. P. Lazarev defended at Warsaw University a doctoral dissertation on "The fading of pigments in the visible spectrum. Experience in studying the principal laws of the chemical action of light." One of the principal results of that dissertation was demonstration of the proportionality of the chemical effect of the quantity of energy absorbed by a gas.

Earlier, with a large group of progressive scientists and instructors, including P. N. Lebedev, P. P. Lazarev left Moscow University in protest against the reactionary policy of Minister of Education Kasso, expressed in particular in the introduction of the policy in the university (1911).

The work of P. P. Lazarev and P. N. Lebedev and their pupils was transferred to the cellar of a dwelling in Mertvyy pereulok (Dead Alley) (now pereulok imeni Ostrovskiy), and shortly after the death of P. N. Lebedev into the physics laboratory of the Moscow Higher Technical School, where Lazarev was elected a professor and work on the kinetics of photochemical processes was continued. Because of illness of P. N. Lebedev, Lazarev had since 1911 replaced him in leadership of the laboratory and Lebedev's pupils, and soon his own pupils had appeared -- B. V. Il'in, V. V. Srebnitskiy, T. K. Molodyy, etc. It was then that P. P. Lazarev suggested to S. I. Vavilov the theme of the first scientific work deveoted to the kinetics of the thermal fading of dyes and its comparison with the kinetics of fading caused by light. Later P. P. Lazarev perspicaciously predicted the important results that later were obtained by S. I. Vavilov and V. L. Levshin in their research on luminescence.

A major event was the founding by the Moscow Society of a number of research institutes, including in 1917 Russia's first research institute of physics, the building of which (according to the design of architect A. N. Sokolov) was built on Miusskaya Place with private funds at the end of 1916. P. P. Lazarev was elected director of the institute. The investigations of P. P. Lazarev and his pupils and associates were expanded in the institute. Working in them were S. I. Vavilov, G. A. Gamburtsev, M. A. Leontovich, P. A. Rebinder and V. V. Shuleykin (later academicians), B. V. Deryagin, A. S. Prodvoditelev and N. K. Shchodro (later corresponding members of the Academy of Sciences), M. P. Volarovich, B. V. Il'in, V. S. Titov, D. M. Tolstoy and E. V. Shpol'skiy (later professors and doctors). After the October Revolution P. P. Lazarev, with the tireless energy characteristic of him, organized a broad front of basic and applied research on the basis of the institute. A laboratory was organized which had the purpose of helping the development of methods of camouflage and decamouflage for the Red Army. In 1920 the Institute of Biological Physics of Narkomzdrav [People's Commissariat of Public Health] was organized (later reorganized into the Institute of Physics and Biophysics, in the work of which participated N. T. and V. I. Fedorov, P. N. Belikov, M. I. Polikarpov, A. S. Akhmatov, P. P. Pavlov, P. O. Makarov, V. V. Yefimov, I. L. Kan and S. V. Kravkov (later corresponding members of the Academy of Sciences USSR). Work was organized on X-ray technology (A. K. Trapeznikov) and its application in medicine, and the X-ray electromedical and photobiological sections were created. Later, the X-Ray Institute of the People's Commissariat of Public Health was created at Solyanka; P. P. Lazarev was its first director. An x-ray photograph of the thorax of V. I. Lenin was made after his villainous wounding in 1922 in the X-ray room of the Institute of Biological Physics (in memory of this a memorial plaque has been installed on the second story).

In 1917 P. P. Lazarev was elected a full member of the Academy of Sciences. He was nominated as academician by the most eminent scientists of the country -- physiologist I. P. Pavlov, mathematician V. A. Steklov, mechanician A. N. Krylov, geochemist V. I. Vernadskiy and chemist N. S. Kurnakov.

The year 1918 was the noteworthy date of the start of work on wide investigation of the Kursk magnetic anomaly. A detailed map of that anomaly, as is known, had been compiled earlier by professor of meteorology E. Ye. Leyst. Leyst died in 1917 in Germany, where he had gone for medical treatment, and the maps taken by him fell into the hands of an adventurer named Stein, who proposed that the Soviet government buy them for 5 million rubles in gold. Unfortunately, in our country there were people who supported that proposal. In connection with that the people's commissar of foreign trade L. B. Krasin appealed to P. P. Lazarev for advice. Petr Petrovich spoke energetically against the proposals of the skeptics who considered our science and technology incapable for practical use of the depths of the earth in the region of the Kursk magnetic anomaly. He reported to L. B. Krasin and G. M. Krzhizhanovskiy that the extensive materials of E. Ye. Leyst were completely unsuitable for practical use: along with careful measurement of elements of the geomagnetic field at numerous points in the investigated region of Russia, Leyst applied those points to a map, guided by roughly approximate determinations of the geographic coordinates and the verbal indications of local inhabitants about the distances of the points from given villages, settlements and cities. Instead of spending gold to acquire the inferior maps of Leyst, P. P. Lazarev proposed organizing a magnetic survey in the same regions by modern operative methods used in the fleet and the simultaneous determination of sufficiently precise coordinates of points by just as operative means, also used in the fleet. Exhaustive instructions on those methods were proposed by academician A. N. Krylov. The proposal of P. O. Lazarev was reported to Vladimir Il'ich Lenin, and by order of V. I. Lenin the Commission for Study of the Kursk Magnetic Anomaly was created under the AS USSR in 1919. P. P. Lazarev was selected as chairman of that academic commission. In the Institute of Physics and Biophysics P. P. Lazarev organized a laboratory in which, under the leadership of N. K. Shchodro, the magnetic properties of specimens of rocks sent in from the field were investigated. In view of the broad scope of the research work the Special Commission for the Study of the Kursk Magnetic Anomaly [Osobaya komissiya po izucheniyu Kurskoy magnitnoy anomalii -- OKKMA] was organized in 1921 by Decree of the Sovnarkom RSFSR. Professor (later academician) I. M. Gubkin, a geologist, was named its chairman, and P. P. Lazarev its deputy chairman, supervising the geophysical part of the study.

In 1923 the drilling gave samples containing iron ore. What ore wealth was discovered as a result requires no explanations! Our country proved to be the richest in the world in iron resources, disposed, moreover, very conveniently from the point of view of closeness to the industrial centers of the country. However, there also were opponents to the study

of the Kursk anomaly, and not only prior to the obtaining of iron ore samples -- many refused then to believe in such a very simple explanation of the anomaly, but even after: they asserted that mining the iron ore could be economically disadvantageous. Undoubtedly not only the scientific perspicacity and boldness of P. P. Lazerev played a role in the success of the discovery of colossal iron ore reserves (including ores of the highest quality in some places) but also his courage in the struggle against opponents and enemies of that undertaking.

P. P. Lazarev combined leadership of the geophysical part of the work with development of the theory of geophysical surveying, in particular the seismic. The latter, successfully applied in the Kursk anomaly, was later widely developed by G. A. Gamburtsev. One of its varieties, the seismoelectric method, based on the discovery of the piezoelectric properties of a number of rocks, was developed and introduced into practice by a pupil of P. P. Lazarev and N. K. Shchodro -- M. P. Volarovich. It is well known how great is the importance of geophysical methods of surveying minerals now. Expressed completely there were P. P. Lazarev's feeling for the new and farsightedness. They were manifested also in his organization of the State Geophysics Institute (later the Institute of Theoretical Geophysics of the AS USSR), of which he was the first director.

In speaking of the geophysical work of P. P. Lazarev one cannot overlook the investigations, accomplished by him for the first time, of the role of the tradewinds in the origination of ocean currents by means of model experiments. The idea of such model experiments was later used also by other scientists, especially V. V. Shuleykin. Sensitively responding to the initiative of associates of the institute and other scientists, P. P. Lazarev contributed in every way possible to the work of V. V. Shuleykin on the physics of the sea at the Black Sea Hydrophysical Station, founded by Shuleykin at the settlement of Katsiveli in the Crimea in 1929. Energetic support on the part of P. P. Lazarev made it possible for that small station be be rapidly developed (later, the Marine Hydrophysical Institute of the AS USSR, now of the AS Ukrainian SSR, grew from it).

After the organization of the Institute of Biological Physics the main attention of P. P. Lazarev was directed toward the further development of biophysics, primarily that direction of it which was given its start by the monograph "Ionnaya teoriya vozbuzhdeniya" [Ionic Theory of Excitation] (1916), subsequently translated into the French (1918) and German (1923) languages and republished in an enlarged edition in 1927. Receiving special development were investigations of changes of the sensitivity of centers of the brain and organs of feeling (peripheral and central vision, hearing, etc) under the influence of stimulating agents, time, the condition of the organism and age. Those investigations were included in the monograph "Issledovaniye po adaptatsii" [Investigations of Adaptation] (published posthumously in 1947).

The main results of those investigations are briefly reduced to the following. As is well known, W. Nernst, and also the Russian physiologist V. I. Chagovets, expressed the hypothesis that nerve endings or muscles are stimulated under the effect of changes of ion concentrations which arise in semipermeable membranes under the effect of electric current. P. P. Lazarev developed a quantitative theory of that effect, using the laws of ion diffusion and transfer in an electric field and the electrical laws of Loeb. The theory was confirmed by experiments conducted in the Institute of Physics and Biophysics and the X-Ray Institute by S. N. Rzhevkin; in those experiments the frequency of the stimulating current was brought to 3×10^5 Hz. The experiments of G. R. Yaure on the transition from aperiodic to periodic muscular contractions at a definite composition of the ionic medium were another confirmation of the theory.

P. P. Lazarev later applied the laws of the stimulating effect of ions to vision and hearing. In the case of vision the agents stimulating the nerve endings are products of the photochemical decomposition of photosensitive pigments present in the rods (during peripheral vision) and cones (during central vision). Hence the close connection between this work of P. P. Lazarev and his photochemical investigations is understandable. If it is taken into consideration that those investigations of photochemical kinetics themselves were pioneering, one can only be surprised at such a high creative potential and breadth of approach of Petr Petrovich.

This fundamental work was the start of an enormous literature on the photochemical theory of vision. That stream has not run dry even now. Let us note especially that the extension of the theory to color vision explains why the theory of color vision in the literature often is rightfully called the Jung-Helmholtz-Lazarev theory.

Before P. P. Lazarev the sensitivity of the eye to change of the brightness of light was treated on the basis of the purely empirical psychophysiological Weber-Fechner law. P. P. Lazarev made a bold step forward, substantiating it by propositions of the photochemical theory of vision. That law with respect to any sensation was later derived from very general concepts of the connection of the differential threshold of sensation with increase of the number of stimulated nerve fibers. Thus the base for a materialistic understanding of sensations was made specific.

P. P. Lazarev later substantially supplemented the theory of differential visual sensations. He showed that the very possibility of perceiving gradations of light can be completely undersoood only if one takes into account both the discreteness of the sensing elements of the retina and the discreteness of the luminous flux -- its quantum nature. A further major contribution to the quantum theory of vision was made by the remarkable investigations of S. I. Vavilov and his associates (Ye. M. Brumberg and others) on the quantum nature of fluctuations of the threshold of

visual sensations. One of the results of those experiments was the conclusion that boundary stimulation of a well-adapted eye during vision corresponds not to a single photon but to a larger number of photons, of the order of magnitude of 5. In accordance with the treatment of Petr Petrovich, it follows from that that to become aware of a flash of light a summation of the stimulations of a number of sensitive fibers is necessary, a summation which possibly occurs in the visual center of the brain. Let us note that the dependence of the boundary number of quanta on the length of the flash, and also the "illuminated" areola, must be connected with the law of that summation. Those investigations of the summation of impressions still await their development, but the far reaching consequences to which the physicochemical theory of vision of Petr Petrovich has led are already clear.

He himself, proceeding systematically, regarded eye sensitivity as a function of the state of the periphery (the degree of decomposition of photosensitive pigments) and the visual centers. This made it possible in a broad cycle of investigations to apply measurements of eye sensitivity to the study of the sensitivity of centers of the brain. In that case a broad study was made of the influence of very different factors, starting with medications and ending with establishing the periodic dependence of that sensitivity on the time of day. One of the most interesting results was the discovery of a general dependence of the sensitivity of the visual centers on age. That curve naturally was obtained from observations made by various tested persons. Nevertheless the scattering of points did not prevent determining the general picture: an increase of sensitivity up to 20-25 years, with a subsequent slow decline -- in its way a reflection of the life cycle.

All this represents only examples and landmarks of the development which investigations in the area of the biophysics of the organs of feeling obtained as a result of the work of P. P. Lazarev and his associates and pupils. That area has attained wide development at the present time. P. P. Lazarev always, and especially in his last years, gave great attention also to the more general questions of biophysics. Of enormous interest is his monograph "Sovremennyye problemy biofiziki" [Contemporary Problems of Biophysics] (published posthumously in 1945), and also earlier monographic outlines -- "Sovremennyye problemy biologicheskoy fiziki i ikh prakticheskoye znacheniye" [Contemporary Problems of Biological Physics and Their Practical Significance] (1933) and "Biophysics in Russia and in the USSR" (1940) in the book of P. P. Lazarev and P. P. Pavlov "Biofizika. Sbornik statey po istorii biofiziki v SSSR" [Biophysics. Collection of Articles on the History of Biophysics in the USSR].

As in other areas of his creativity, P. P. Lazarev always very closely and very directly linked basic research with its practical application. Numerous and comprehensive investigations were conducted by him in the area of the application of adaptation for diagnostic purposes in various

diseases, and also for the analysis of various physiological states and the effect of medications. The circle of interests of P. P. Lazarev also included questions of the dynamics of biological populations, the growth of normal and tumorous formations, the influence of the closing of an external magnetic field on the blood vessels of the frog, conditioned reflexes and the mechanism of higher nervous activity, reasons for the origination of epilepsy and many others. To all these questions he contributed original judgments and obtained new data.

Not all his published articles were of the same value (could it be otherwise?), but the trail he left is enormous and lasting. P. P. Lazarev is rightfully one of the founders of biophysics as a science and a creator of Soviet biophysics. His role in that is determined by his brilliant and original talent, his ability to connect phenomena and laws apparently remote from one another, the intellectual ability, characteristic of him, to see the general behind the particular, enormous erudition in a very extensive area, and ability to evaluate the prospects of both particular investigations and of various sciences and branches of knowledge. The latter qualities of P. P. Lazarev undoubtedly are closely connected with his love for the history of science and his knowledge of it. In connection with the jubilee of the Academy of Sciences he wrote a brilliant historical survey of the development of the exact sciences in Russia in 200 years, a brief history of Russian physics, and other historical surveys. He wrote brilliant and interesting biographies of the Russian physicists P. N. Lebedev, A. G. Stoletov, B. B. Tolitsyn and N. A. Umov, and also outlines on Rutherford and Newton.

In parallel with the development of biophysical investigations, investigations in the area of physics and physical chemistry were intensively developed in the Institute of Physics and Biophysics of Narkomzdrav. Conducted in them in the 1920's were the investigations of luminescence of S. I. Vavilov, V. L. Levshin and L. A. Tummerman, of the electrical properties of liquids of N. K. Shchodro, the optical investigations of G. S. Landsberg, investigations on the physics of the sea of V. V. Shuleykin and the molecular physics work of A. S. Predvoditelev and B. V. Il'in. P. A. Rebinder discovered the effect of adsorptive reduction of hardness, and the present author -- the elasticity of shear of thin layers of water, and under the leadership of P. P. Lazarev investigations were conducted of photochemical processes important for the industrial obtaining of sulfuric acid and clarification of the mechanism of carbon dioxide assimilation. Thus the institute was the scientific center of Moscow in physics.

P. P. Lazarev not only was able to find practical application of the obtained scientific results but also promptly responded to various practical inquiries, arranging purely theoretical investigations in parallel with the solution of practical problems.

Besides investigations generated by the puzzle of the Kursk magnetic anomaly, a brilliant example of this also is work on the physics of the glassy state, which was important for the development of the glass industry. Upon his initiative, for the first time in the world measurements were arranged (in 1928) of the viscosity of fused glasses, made by two different methods which gave agreeing results by M. P. Volarovich and D. M. Tolstoy, on the one hand, and B. V. Deryagin and Ya. S. Khananov, on the other, in the Institute of Physics and Biophysics. Complete clarity in the question of the nature of hardened glass was contributed by experimental investigations headed by P. P. Lazarev with the simultaneous participation of associates of the Institute of Silicates (A. P. Zak, Yu. P. Simakov, S. I. Ioffe and others). Since clayey compositions play an important role in the silicate industry, P. P. Lazerev was interested in nature of the plasticity of clays. Analyzing that question, he introduced the concept of the basic role of very fine interlayers of water and their anisotropic structure in that property of disperse systems. And here his intuition expressed itself. In further works of the author of this article and his associates and other scientists in our country and abroad on special properties of thin liquid interlayers an entire world of phenomena was discovered which makes it possible to quantitatively explain the principal properties of disperse systems with a liquid dispersion medium, and has changed the face of colloidal science. The master's dissertation of P. P. Lazarev on the experimental study of the temperature distribution in a rarefied gas between two unidentically heated plates also had great consequences. That work, done on a high experimental level, served as one of the bases for calculations of the motion of aerosol particles both under the influence of a temperature gradient (thermophoresis), which was shown by Yu. I. Yalamov, S. I. Bakanov and the author, and also under the influence of illumination (photophoresis and radiometric effect). By virtue of the principle of similarity the temperature jump and accompanying gas-kinetic phenomenon play an important role also in calculations of the motion of large objects in the stratosphere.

The influence exerted by P. P. Lazarev on the development of Soviet biophysics, geophysics, molecular physics and photochemistry was intensified to an enormous degree by his fruitful organizational and social activity. His speech was not characterized by smoothness or oratorical devices but was attractive because it clearly showed the importance of the subject and avoided unessential details and tedious passages. The main thing, which attracted all in contact with him, was his unlimited dedication to science, exceptional scientific temperament and straightforwardness of judgments. Without those qualities and his personal charm his tireless activity could not have been accomplished and his scientific school, which included a number of very eminent scientists eelebrated for work in very different directions, could not have grown.

Alas!. That straightforwardness and directness sometimes led to misunderstandings, but only with people who could not appraise those qualities. The life of P. P. Lazarev -- and he did not conceive of it without science -- also encountered thorns, and often recognition was delayed. But time is a very rigorous and just judge, and now, 36 years after the death of P. P. Lazarev, it has become still clearer how important his work was not only in the historical perspective but also in the light of the development of his ideas now and in the light of problems of the present day.

The development of the physical and physicochemical approaches to biological problems, the establishment of applied geophysics, which from the very beginning gave our country colossal iron reserves, now being intensively worked, the principles of photochemical kinetics and new areas of molecular physics serve as monuments to P. P. Lazarev.

For those who knew P. P. Lazarev and worked with him, the memory of him as a man who always in fact manifested deep dedication to science and patriotism and was always ready to help anyone who needed his help in scientific or everyday questions, will always be preserved.

2174
CSO: 1870

JOURNAL 'USPEKHI FIZICHESKIKH NAUK' CELEBRATES 60TH ANNIVERSARY

Moscow USPEKHI FIZICHESKIKH NAUK in Russian Vol 125 No 1, May 78 signed to press 18 Apr 78 pp 7-10

[Article by Journal's Editorial Board]

[Text] The 60th anniversary of the journal, which coincided with the 100th anniversary of the birth of its founder and first editor, academician Petr Petrovich Lazarev, gives grounds for reminding present-day readers, even if briefly, of the social circumstances in which the journal originated.

In pre-revolutionary Russia there were no scientific research institutes of physics which had the special task of working out physical problems, whereas abroad such institutes had already become the main centers of the development of science. In Russia physics was developed in the departments, in "studies" equipped primitively on the basis of the scanty, sometimes personal, resources of professors. A small group of physicists worked in the Saint Petersburg VUZ's, in Moscow the physicists were united around P. N. Lebedev, and loners worked in other cities. The largest school was that of P. N. Lebedev at Moscow University. But in 1911 P. N. Lebedev and his associates left the university in protest against repression of the government with regard to an elective rectorate and student riots. Lebedev's school lost its university base, and, soon after, also its leader, who died after a heart attack on 14 March 1912.

Lebedev's scientific school proved to be viable, however. Even during the life of P. N. Lebedev it was supported by the progressive community, the Moscow Society of the scientific institute was formed, private donations were collected, and later the Physics Institute at Miussy was constructed and equipped. It was opened in January 1917. All the scientific organizational activity after P. N. Lebedev was headed by his pupil and closest assistant, P. P. Lazarev, who became an academician in 1917. He also was elected director of the first Scientific Research Institute of Physics.

Under such difficult conditions Soviet physics developed at the beginning of this century. And yet it displayed magnificent achievements; for example, one can point to the experimental detection and measurement of the pressure

of light by P. N. Lebedev, the "elementary photoelectric effect" of A. F. Ioffe, and investigations of anomalous dispersion in sodium vapors of D. S. Rozhdestvenskiy.

The Great October Socialist Revolution of 1917 opened up broad prospects of the development of physics. Science not only received the support of the leaders of the party and government but it was set an enormous task, that of elevating the scientific and technological level of the national economy of the young socialist country. It was the time when large-scale scientific research institutes were conceived and created -- the Physicotechnical Institute, the Optical, the Aerohydrodynamic, etc. Physicists actively joined in the construction of Soviet science and the training of scientific personnel, the need for which grew rapidly. As the most important emerged that of organizing rapid information about the contemporary state of physics, its problems and its latest achievements. It was the time when physics penetrated the atomic area, when new quantum and relativistic ideas were consolidated, unexpected effects were discovered and more precise methods of investigation were developed. At that time a need became evident for a survey publication devoted to generalization of the latest advances of physics.

Such a publication -- USPEKHI FIZICHESKIKH NAUK -- was created at the beginning of 1918. Its founding editor was P. O. Lazarev, and his deputy -- E. V. Shpol'skiy (who also belonged to the school of P. N. Lebedev), and beginning in 1924 (Volume 4) the names of both of them were published on the title page as co-editors; E. V. Shpol'skiy later headed the editorial board, until his death in 1975. (For an article devoted to his memory, see UFN, Vol 118, No 1, 1976). Among the first authors of the journal were many pupils of Lebedev, and S. I. Vavilov later became a member of the editorial board.

Thus it can be said that the journal USPEKHI FIZICHESKIKH NAUK was a direct creation of the Lebedev school of physicists.

It was a merit of the first leaders of the journal that they were able in the very first years to unite around the journal both venerable men already physicists then and the scientific youth of that time, who later became eminent scientists. As E. V. Shpol'skiy correctly wrote 10 years ago, "there was not an active Soviet physicists, starting with the founders of Soviet science Ioffe, Lazarev and Rozhdestvenskiy, and the first ranks of the then young physicists Vavilov, Kurchatov, Kalitsa, Semenov, Tamm, Frenkel' and Fok and ending with their pupils and the pupils of their pupils, who did not publish in USPEKHI. The organizers and leaders of the journal displayed a feeling for substantiated novelty in science which permitted them in the course of decades to correctly orient Soviet physicists in genuinely scientific values. This required from them both love for science and broad erudition, and created deserved authority for the journal.

Noting the 60th anniversary of USPEKHI, the editorial board together with the readers of the journal take cognizance of its highly useful activity.

2174
CSO: 1870

FORUM OF COSMONAUTIC ENTHUSIASTS

Moscow KRYL'YA RODINY in Russian No 6, 1978 p 26

[Article by V. Saginov, candidate of technical sciences, State Prize Laureate, and P. Starostin]

[Text] The 8th Gagarin Science Readings took place in Moscow in March-April under the aegis of new and outstanding achievements by Soviet cosmonautics. Instituted in 1971 to mark the first manned space flight, this year the Readings were especially active and fruitful. This was facilitated by bringing into the work of the sections new groups of enthusiasts in space development and in using results of flights by manned and automatic space apparatus in the interests of science and the national economy, and also by associating them with the readings devoted to elaborating the theoretical heritage of Academician S. P. Korolev, the founder of practical cosmonautics.

The briefings and scientific reports before sections and plenary sessions emphasized that our country was achieving ever increasing success in this one of the most important directions of scientific-technical progress thanks to the constant concern by the Communist Party and Soviet government for ensuring that native cosmonautics develops at accelerated tempos. The most vivid evidence of this is the flight of the Salyut-6/Soyuz orbital scientific research complex. Evaluating the services of participants of one of the outstanding phases of man's development of space, Comrade L. I. Brezhnev said at an award ceremony for pilot-cosmonauts: "That which was done over a period of almost 100 days at the end of 1977 and in January-March 1978 is a genuine exploit. It is a scientific, technical and organizational feat, but above all, a purely human exploit."

The flight of the Salyut-6/Soyuz complex, which became a tangible contribution toward accomplishing decisions of the 25th CPSU Congress on development of space research and the use of outer space for peaceful purposes; the launch of the 1,000-th "Kosmos" series artificial earth satellite at the beginning of April; and results of the flights by Salyut-5 stations and Soyuz spacecraft which preceded them naturally left their imprint on the preparations and content of the work of all sections and plenary sessions of the Readings. Above all, there has been

an increase in comparison with last year in the number of organizations wishing to take part in the Readings. They put forth for discussion 282 briefings and reports by specialists in various fields of space science, technology, and space medicine and biology. The 205 briefings and reports included in the program of the Readings were authored by 5 pilot-cosmonauts, 55 doctors of sciences, 181 candidates of sciences and 226 engineers and physicians. The remaining 77 were recommended for discussion at the 1979 Readings and correspondingly narrower science seminars and conferences.

Plenary sessions of the Readings were preceded by much fruitful work by over 10 sections and subsections. Their sessions heard a majority of the briefings and scientific reports on individual problems of cosmonautics. Questions of flight mechanics were discussed in two subsections. One of them, the "Flight Dynamics" section, examined 20 briefings and reports devoted primarily to parameters of space apparatus movement, including air and spacecraft on various near-earth and interplanetary routes as well as in sectors of descent in the atmosphere.

The primary content of the work of the "Problems of Flight Dynamics and Heat-Mass Exchange" subsection was an examination of problems of thermal design of flying craft and a determination of their heat-reflecting coatings. A distinguishing feature in the work of the "Flight Mechanics" subsection this year was the fact that there was a broader and more comprehensive examination of problems involving the flight of winged craft in the range of altitudes from 40 to 120 km.

The 29 briefings and reports heard at sessions of the "Flying Craft Control Systems" section examined problems of orientation, stabilization and control of spacecraft and the methodology for automated design of control systems for spacecraft. It is worthwhile to note in passing that it is not the first year that methods of automating design in the "TsVM [digital computer]-designer" dialogue mode have been discussed widely by participants of the Readings in this section.

Two very important problems were the focus of attention by participants in the work of the "Design and Development of Flying Craft section. Briefings and reports examined problems of designing spacecraft using modern computers as well as problems of developing spacecraft. Section speakers regarded the creation of a permanent seminar on automated flying craft design and development systems as desirable and useful for the work.

Briefings and scientific reports given at the "Use of Spacecraft in the Interest of the National Economy" section were devoted to problems of increasing the effectiveness of using space science and technology and the data received from aboard manned and automatic spacecraft for national economic needs, for environmental protection and for advisable use of our planet's resources. Particularly meaningful were the briefings on the use of space photographs for exploring for fresh underground water in sandy deserts, on photographic observations of geostationary satellites for mapping regions difficult of access, and a number of other briefings.

The authors of briefings and reports given before the "Problems of Aviation and Space Medicine and Biology" section devoted most of them to psycho-physiological and psychological problems of prolonged space flights and the results of medical and biological investigations aboard the Salyut-5 orbital station.

Material presented and discussed in the section is of specific practical interest and will facilitate the resolution of new problems arising in connection with the rapid development of manned space flights and an increase in their duration.

The "Spacecraft Life Support and Crew Safety Systems" section was one of the most active and productive sections of the Readings. There was a two-day meaningful talk on many problems of improving spacecraft life support and crew safety systems at sessions of the "Biomechanics, Ergonomics and Spacecraft Crew Safety Equipment," "Spacecraft Thermal Conditions Support Systems" and "Spacecraft Gas and Liquid Regeneration Systems" subsections.

Participants of the Readings heard briefings and scientific reports in the "Aviation and Space Technology" section which examined in particular problems of selecting design ballistic parameters, methods for calculating the impact of spacecraft on the surface of deforming soil, and other problems.

Over 20 briefings and scientific reports were heard and discussed at sessions of the "Technology In Space" section. Great interest among them was generated by briefings on technological experiments performed aboard the Salyut-5 station. The section discussed certain questions of the assembly, repair and maintenance of craft in space and principles of creating the necessary hand tools and devices for such work.

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This year students of the Moscow Aviation Technology Institute imeni K. Tsiolkovskiy, the Moscow Aviation Institute imeni S. Ordzhonikidze, the Moscow Higher Technical School imeni N. Bauman, the Moscow Engineering-Physics Institute, and the Second Medical Institute devoted their Gagarin Readings (which took place from 31 March through 4 April) to the 60th Anniversary of the Lenin Komsomol. Seventy representatives of five of the capital's universities covered a number of problems of space flight mechanics, the methodology of testing spacecraft, space technology, biology and medicine, the work of control systems, and the sociopolitical importance of space development in briefings and reports in six sections. Speaking to students at plenary sessions were General Aviation Designer A. Tupolev, USSR Pilot-Cosmonaut Yu. Glazkov, professors Ye. Kovalenko, V. Karagodin and G. Leonov, and other figures of science and technology.

The work of all sections at the 8th Readings was distinguished on the whole by a high quality of content. The lively, imaginative discussion of briefings and reports facilitated the establishment of a closer cooperation among specialists working in related fields. The following persons spoke in concluding plenary sessions of the Readings: academicians A. Yu. Ishlinskiy and N. D. Dubinin, USSR Pilot-Cosmonaut A. A. Leonov, USSR Academy of Sciences corresponding members V. S. Avduyevskiy and B. V. Raushenbakh, doctors of sciences N. M. Skomorokhov, G. S. Narimanov and K. A. Lyushinskiy. They told about the work of Soviet scientists, cosmonauts and specialists in various fields of science and technology who are helping to understand the secrets of the Universe and the use of space for peace and progress on earth.

Having become a tradition, the Gagarin Science Readings are becoming more and more popular in our country and the scientific level of briefings and reports is growing. They are becoming more meaningful and the plenary and section sessions are becoming more and more massive. Over 3,500 enthusiasts of native aviation and cosmonautics took part in the 8th Readings, which have ended. The briefings and scientific reports before sections and plenary sessions help in the solution to a number of problems of further development of cosmonautics and aviation in our country.

Taking part this year in preparations and conduct of the 8th Gagarin Readings dedicated to World Aviation and Cosmonautics Day and the 2nd Readings devoted to elaboration of the creative heritage of Academician S. P. Korolev was the USSR Academy of Sciences, the Cosmonaut Training Center imeni Yu. A. Gagarin, the Air Academy imeni Yu. A. Gagarin, the Central Aviation and Cosmonautics Club imeni M. V. Frunze, the USSR DOSAAF Cosmonautics Committee, the USSR Federation of Aviation Sport, the Moscow Aviation Institute imeni Sergo Ordzhonikidze, the Soviet National Association of Natural Science and Technology Historians, and the Moscow Aviation Technological Institute imeni K. E. Tsiolkovskiy. The International Aviation Federation (FAI) awarded the collective of the Aviation and Cosmonautics Club imeni M. V. Frunze an honorary FAI Diploma and awarded its director, V. F. Bashkirov, the FAI Gold Medal for a great contribution to the cause of disseminating knowledge in the field of aviation and cosmonautics.

6904
CSO: 1870

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

AUTHORS AND AFFILIATIONS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 1, Jan/Feb 78 pp 142-143

[List of authors and their affiliations]

[Text] AUTHORS

Alekseyev, Oleg Glebovich, candidate of technical sciences (Leningrad)
Ariskin, Nikolay Ivanovich, engineer, FEI [Institute of Physics and Power Engineering] (Obninsk)
Babayev, Aleksandr Aleksandrovich, junior scientific worker (Leningrad)
Balyasnyy, Leonid Markovich, candidate of technical sciences (Khar'kov)
Belov, Vladimir, Nikolayevich, Intervuz Computer Center, Riga Polytechnic Institute (Riga)
Belyavskiy, Viktor Leonidovich, candidate of technical sciences, GI [expansion unknown] Computer Center, Minvodkhoz [Ministry of Water Resources] Ukrainian SSR (Kiev)
Bobovskiy, Valeriy Vladimirovich, candidate of technical sciences, NPO [Scientific-Production Association] "Kristall" (Kiev)
Bogdanov, Sergey Vladimirovich, engineer, FEI (Obninsk)
Boguslavskiy, Il'ya Veniaminovich, engineer, INEUM [expansion unknown] (Moscow)
Burlakov, Mikhail Viktorovich, graduate student, IK AN USSR [Institute of Cybernetics, Academy of Sciences Ukrainian SSR] (Kiev)
Vaynzof, Aleksandr Mikhaylovich, All-Union Scientific Research Technological Institute of the Pipe Industry (Dnepropetrovsk)
Gerasimov, Anatoliy Mikhaylovich, engineer, LIYaF AN SSSR [Leningrad Institute of Nuclear Physics, Academy of Sciences USSR] (Leningrad)
Glukhova, Larisa Fedorovna, senior scientific worker, INEUM (Moscow)
Gofman, Eduard Igorevich, engineer, Sinarskiy Pipe Plant (Kamensk-Uralskiy)
Grachev, Arkadiy Vasil'yevich, engineer, FEI (Obninsk)
Grekhov, Igor' Aleksandrovich, plant director, Sinarskiy Pipe Plant (Kamensk-Ural'skiy)
Grizodubova, Ol'ga Nikolayevna, senior scientific worker, VNIIPOU [expansion unknown] (Moscow)
Grishchenko, Vladimir Nikolayevich, engineer, SKB [Special Design Bureau] MMS [expansion unknown], IK AN USSR (Kiev)

Dovgyallo, Aleksey Mikhaylovich, candidate of technical sciences, IK AN USSR (Kiev)
Drozdenko, Konstantin Vasil'yevich, senior scientific worker (Kiev)
Yefimov, Vladimir Maksovich, candidate of economic sciences, MGU [Moscow State University imeni M. V. Lomonosov] (Moscow)
Zabara, Stanislav Sergeyevich, candidate of technical sciences, "Elektronmash" PO [Production Association] (Kiev)
Zapolotskiy, David Yefimovich, engineer, Scientific Research Institute of Mechanics at GGU [Gor'kiy State University imeni N. I. Lobachevskiy] (Gor'kiy)
Zakharov, Viktor Nikolayevich, junior scientific worker, INEUM (Moscow)
Ivas'kiv, Yuriy Lukich, candidate of technical sciences, IK AN USSR (Kiev)
Ileyko, Vitaliy Mikaylovich, general director, "Polet" PTO [Production and Technical Association] (Chelyabinsk)
Kabenin, Vyacheslav Nikolayevich, candidate of technical sciences, FEI (Obninsk)
Karpenko, Sergey Nikolayevich, junior scientific worker, Scientific Research Institute of Mechanics at GGU (Gor'kiy)
Kirpichnikov, Viktor Mikhaylovich, candidate of technical sciences, MRTI [Minsk Institute of Radio Engineering] (Minsk)
Klopov, Nikolay Visil'yevich, engineer, LIYaF AN SSSR (Leningrad)
Kozlova, Lyudmila Mikhaylovna, engineer, INEUM (Moscow)
Kozmidiadi, Vladimir Aleksandrovich, candidate of technical sciences, INEUM (Moscow)
Kozmidiadi, Nataliya Pavlovna, senior scientific worker, INEUM (Moscow)
Komarov, Vladimir Fedorovich, candidate of economic scineces, Scientific Research Institute of Systems (Novosibirsk)
Kostenko, Vasiliy Savovich, engineer, Institute of Automation (Kiev)
Kotok, Valeriy Borisovich, engineer (Khar'kov)
Kravchuk, Anatoliy Iosifovich, engineer, IES AN USSR [Electric Welding Institute imeni Ye. O. Paton, Academy of Sciences Ukrainian SSR] (Kiev)
Krasilovets, Lyudmila Vasil'yevna, engineer, IK AN USSR (Kiev)
Kulabukhov, Yuriy Sergeyevich, senior scientific worker, FEI (Obninsk)
Kulikov, Artem Vladimirovich, engr, LIYaF AN SSSR (Leningrad)
Kutsenko, Andrey Varfopolomeyevich, candidate of technical sciences, FI AN SSSR [Physics Institute, Academy of Sciences USSR] (Moscow)
Lavrishcheva, Yekaterina Mikhaylovna, candidate of physical and mathematical sciences, SKB MMS IK AN USSR (Kiev)
Landau, Igor' Yakovlevich, candidate of technical sciences, INEUM (Moscow)
Lebedev, Valerian Leonidovich, engineer, NIIAR (Dimitrovgrad, Ul'yanovskaya Oblast)
Lipayev, Vladimir Vasil'yevich, doctor of technical sciences (Moscow)
Lysenko, Aleksandr Yefimovich, engineer (Kiev)
Matalin, Lev Aleksandrovich, doctor of technical sciences, FEI (Obninsk)
Mil'ner, Anatoliy Davidovich, candidate of technical sciences, "Elektronmash" PO (Kiev)
Mil'shin, Valeriy Ivanovich, engineer, FEI (Obninsk)
Minko, Yuriy Vital'yevich, engineer, FEI (Obninsk)
Mikheyev, Geliy Fedorovich, engineer, LIYaF AN SSSR (Leningrad)

Naymushin, German Aleksandrovich, engineer (Moscow)
Nanasyan, Aram Sergeyevich, candidate of technical sciences, Yerevan Physics Institute, GKAE [State Candidate for the Use of Atomic Energy USSR] (Yerevan)
Nekrasova, Leonina Nikolayevna, engineer, IK AN USSR (Kiev)
Nikitin, Andrey Ivanovich, doctor of technical sciences, IK AN USSR (Kiev)
Novodvorskiy, Yevgeniy Grigor'yevich, engineer, LIYaF AN SSSR (Leningrad)
Novozhilov, Nikolay, Aleksandrovich, engineer, Sinarskiy Pipe Plant (Kamensk-(Ural'skiy)
Olefir, Lyudmila Venediktovna, senior scientific worker, INEUM (Moscow)
Ofengenden, Rafail Grigor'yevich, doctor of technical sciences, Nuclear Research Institute, Academy of Sciences Ukrainian SSR (IYaI AN USSR) (Kiev)
Peskov, Vladimir Ivanovich, junior scientific worker, Scientific Research Institute of Mechanics at GGU (Gor'kiy)
Petrenko, Anatoliy Ivanovich, doctor of technical sciences, KPI [Kiev Polytechnic Institute] Kiev
Pogrebnoy, Nikolay Vasil'yevich, candidate of technical sciences, IES AN USSR (Kiev)
Pogola, Nikolay Vasil'yevich, candidate of technical sciences, IES AN USSR (Kiev)
Pshenichnyy, Lev Ivanovich, engineer, IES AN USSR (Kiev)
Ryabov, Yuriy Fedorovich, candidate of technical sciences, LIYaF AN SSSR (Leningrad)
Sapova, Yelena Viktorovna, junior scientific worker, KPI (Kiev)
Sakharov, Vyacheslav Aleksandrovich, engineer, FEI (Obninsk)
Sachko, Inna Vladimirovna, All-Union Scientific Research Technological Institute of the Pipe Industry (Dnepropetrovsk)
Sergeyev, Aleksandr Aleksandrovich, engineer, GlavNIIVTs [expansion unknown] of the Gosplan Ukrainian SSR (Novosibirsk)
Sidorov, Venamin Aleksandrovich, corresponding member of the Academy of Sciences USSR, IYaF SO AN SSSR [Institute of Nuclear Physics, Siberian Department, Academy of Sciences USSR] (Novosibirsk)
Sklyarov, Valeriy Anatol'yevich, graduate student, MRTI (Minsk)
Smolich, Grigoriy Grigor'yevich, engineer (Moscow)
Sysoletin, Boris Leonidovich, engineer, IYaF SO AN SSSR (Novosibirsk)
Timofeyev, Boris Borisovich, corresponding member of the Academy of Sciences Ukrainian SSR, Institute of Automation (Kiev)
Timokhin, Lev Aleksandrovich, candidate of technical sciences, FEI (Obninsk)
Trubnikov, Vitaliy Romanovich, engineer, FEI (Obninsk)
Ushakov, Viktor Aleksandrovich, engineer, Institute of Automation (Kiev)
Fedorov, Yuriy Dmitriyevich, candidate of technical sciences, NIIAR [expansion unknown] (Dimitrovgrad, Ul'yanovskaya Oblast)
Tsurin, Oleg Filippovich, candidate of technical sciences, KPI (Kiev)
Chubarov, Sergey Ivanovich, candidate of technical sciences, FEI (Obninsk)
Shastova, Galina Alekseyevna, doctor of technical scinces, VNIIPOU (expansion unknown] (Moscow)

Shelepov, Gennadiy Ivanovich, engineer, FEI (Obninsk)
Shteyman, David Mikhaylovich, engineer, Scientific Research Institute of Mechanics at GGU (Gor'kiy)
Shtrik, Aleksandr Arkad'yevich, candidate of technical science (Moscow)
Shuvalov, Boris Nikolayevich, engineer, IYaF SO AN SSSR (Novosibirsk)
Yulin, Boris Illarionovich, candidate of technical sciences (Moscow)
Yurovskiy, Boris Yur'yevich, graduate student, MISiS [expansion unknown] Moscow

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END